

STUDY OF ARCHITECTURAL ASPECTS ON RESETTLING TSUNAMI VICTIMS IN SRI LANKA

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A dissertation Presented to The Faculty of Architecture for M.Sc. (Architecture) Examination



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Abstract

Natural Disasters cause mainly loss of "Lives", "Homes", and "Places". Homes at a micro level and Place at a Macro level are the reflections of people's Cultural, Social and Economical aspirations as well as Relation to the community and the Environment. After a Natural Disaster, Resettlement of disaster victimized facilities take place. This arise need of Professional assistance and guldens, Because it is a long process of Articulating the space meaningfully. Hence the need of Architect is vital



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DECLARATION

I declare that this dissertation represents my own work, except where due acknowledgement made, and that it has not been previously included in a theses, dissertation or report submitted to the university or any other institution for a degree, diploma or other qualification.



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Introduction

Topic Explanation

Disaster is an event, located in time and space, which produces the conditions, whereby the continuity of the structure and the process of social units become problematic.

Disaster can be classified in to two categories, natural and man made, which could be sudden or progressive.

Natural disasters incorporate categories like hydrological such as flood, storm, etc. meteorological such as hurricanes, cyclones, typhoons or tornadoes, and geographical such as earthquakes and volcanoes and Tsunami.

Man made disasters encompass war, civil strife, fire explosions, mining, catastrophes and damage, contamination of air, water, soil, large scale traffic accident, etc.

The sudden occurrence of disaster without any warning and the violence of movements, in a few seconds turn a prosperous town in to a pile of rubble. This could be a treat to human life and property and ultimately leading to confusion and suffering of human life. ^{threat} ?

World fourth largest natural disaster was happened 26th of December 2004. It contributed to the massive loss of life and property. After disaster there may be confusion and suffering but there also aid for rehabilitation. ^{arise the need for it} Where, re- Settlements become an important aspect of rehabilitation of people soon after a disaster.

In most situations, re- settlement has never been a successful task. It is often found that the product given to the people is often rejected.

The people will continue to suffer from a 'sense of loss'. Re- settlement is not just something which produces buildings for shelters; it is a wider process of giving a new life to the victims, making them psychologically and physically comfortable.

Need of the study

Tsunami is an unprecedented natural disaster not only for Sri Lanka as well as some of other Asian countries. Sri Lankan people have never experienced such a rapid disaster recently. Therefore rebuilding would be a great challenge for the people. In this case, there are negative aspects more than positive aspects, because Government, Non government organizations as well as foreign assistance team^s have^{got} involved in re settlement of tsunami victims. But it needs the presence of professionals for this purpose, especially architects.

The importance of re- settlement has critical connection with architectural involvement. It ^{should} would be understood and sufficiently highlighted. Hence there is a need of study^{would} to observe, study and highlight the importance of architectural involvement in re- structure^{ing} the built environment.

Intention of the study

Re settlement is not always been accepted by people and the natural environment, because community's identity depends on its belongingness to the location where they settle.

Hence, destruction of the built environment creates an impact on community and its identity. It is important to identify socio cultural and economical background of the victims, before re settle^{ing} them. Because of the non architectural involvements, the communities have^{to} face so many issues according to their life style.

The intention of the study is to identify positive as well as negative aspect^s in re settlement and the importance of architectural involvement. How far it is improved^{can} the future social, cultural and economical environment.

Methodology

First chapter will discuss about the Natural disaster and its physical social and psychological impact and the process of the re settlement. Especially in this chapter will discuss the Tsunami disaster and its impact on environmental, socio cultural economical and psychological environment of Sri Lankan. Impact on the built environment, especially residential impact is widely discussed.

Second chapter will examine three case studies, which are identified in North east and Southern province in Sri Lanka where the locations were hard hit by the tsunami. Case studies will examine the socio cultural background of the victims and their general living pattern which is affected by the Tsunami.

Each case study will study the architectural as well as non architectural involvement in re settle the identified affected community. It will discuss as immediate response and long term response.



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Third chapter will identify the characteristics of the architectural involvement comparing with the non architectural involvements, which create positive improvements in the future according to the cultural, social, and economical aspects of the affected communities.

Scope and limitations

The main idea of the study is to establish the importance of architectural involvement of re structuring the built environment. Hence study will not go in to depth disaster management and place making and issues like conservation.



Chapter one:

Natural Calamity, Tsunami Disaster and Sri Lankan Built Environment; A background study

1.1- Natural Calamities

The earth supports a human population which, in general, is more numerous, healthier and wealthier than ever before. At the same time, there is an unprecedented awareness of risks in the environment together with a growing concern for the continuing death and destruction caused by natural hazards.

A precise definition of environmental hazards is difficult, Burron and Kates (1964a) defined Natural disasters as *“Those elements of the physical environment harmful to man and caused by forces extraneous to him”*¹

Hazard and risk can be increased or reduced by human actions, but when large numbers of people are killed, injured or affected in some way, the event is termed a disaster. Disaster is an actual happening, rather than a potential threat, so the disaster may be simply defined as *“the realization of hazard”*

Disaster can be defined as;

*“An event, concentrated in time and space, in which a community experiences sever danger and disruption of its essential functions, accompanied by widespread human, material or environmental losses, which often exceed the ability of the community to cope without external assistance”*²

Another definition for natural disaster is, *“an accident such as an earthquake or flood, that is not caused by human beings, which cause great damage or loss of life”*³

¹Smith, K. (1991), *Environmental Hazards*, London: Routledge, New fetter lane, London, p- 17

² Smith, K. (1991), *Environmental Hazards*, London: Routledge, New fetter lane, London, p 18

³ Smith, K. (1991), *Environmental Hazards*, London: Routledge, New fetter lane, London, p- 18

Disasters are classified as rapid on-set or cataclysmic, and long-term or continuing. In a cataclysmic disaster, one large-scale event causes most of the damage and destruction. Following this event, there may be a tremendous amount of suffering and chaos, but things soon begin to improve. In a long term, continuing disaster, the situation after the event remains constant or may even deteriorate as time passes.

Cataclysmic disasters include earthquakes, tsunamis, volcanic eruptions, cyclonic storms, and floods.

Continuing disasters include droughts, crop failures. Cataclysmic disasters destroy buildings and entire human settlements. Loss of life is sudden and therefore dramatic.

Earthquakes

Of all natural disasters, earthquakes seem to be the most terrifying. They can inflict tremendous damage within seconds and without warning at any time of day, of any day of the year.

It damage buildings, dams, collapse underground structures such as caves and tunnels, offsets streams, road and bridges. Earthquake losses are largely preventable. Approximately 90% of the loss of life in all earthquakes is the result of buildings collapse. Until recently, this was unavoidable; but more is known about the nature of earthquakes and their effects now.

Ground shaking and surface faulting are often just the forerunners of secondary damage, such as fires, floods, land slides, Rock and snow avalanches, and Tsunamis (seismic sea waves)



Fig.1-City in to pile of rubble after earthquake

Tsunamis

As a secondary effect of the earthquakes far of more concern are tsunamis, the large sea waves caused by an earthquake abruptly moving the ocean floor.

The waves move at a high velocity and can cross thousands kilometers before they run up on shore.

Flooding impact damage from giant waves destroys manmade structures and crops; scour land.

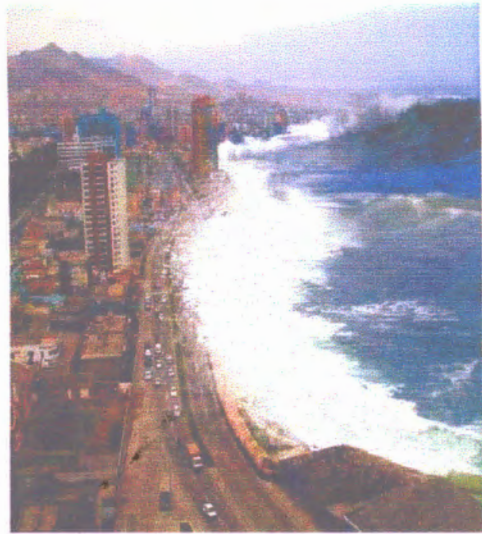


Fig.2- Tsunami tidal waves on Thailand

It is dangerous because areas far from the earthquake's epicenter can be struck without warning. Especially it is dangerous where hundreds of remote, low-lying islands with poor communications cannot be given adequate warning.



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Cyclones

Cyclones cause loss of lives, houses, crops, food stocks, and land. Winds do not most damage to buildings, but most death results from the flooding that accompanies the storm.

The most dramatic effect of cyclones is the damage they cause to houses. Contrary to popular belief, few houses are blown over.

Floods

Floods kill. They kill by destroying houses, crops and food stocks. Each year, floods take an increasing number of lives and an increasing amount of property.



Droughts

Drought has long been recognized as one of the most insidious causes of human misery. While generally associated with semiarid or desert climates, droughts can occur in areas that normally enjoy adequate rainfall and moisture levels.

Droughts effects can be classified as primary and secondary. Primary effects follow directly from the lack of water: decreased food production and impairment of agricultural economics, damage to land, loss of plant and animal life, reduction of human consumption and hygienic use of water. Secondary effects follow from the primary ones: economic loss, radical population shifts, and post drought erosion and flooding.

There are many other natural hazards occurring each year, such as fires, tornadoes, landslides, volcanoes and etc. They are depending on the magnitude of the phenomenon and the size of the effected population. Each has various primary and secondary effects.

Natural disasters can be again classified as preceded and unpreceded. Preceded means, some of the countries always affect by natural disasters like earthquakes, volcano irruptions and etc. As an Example, Earthquakes are familiar and well known by Japan, because they always face earthquakes.

But the situation is differing, when the natural disaster is unpreceded. It will cause severe damage and loss of lives.



Re- settling after disasters

There are three classes of disaster victims. Primary victims-those persons living within the disaster affected areas who have suffered injury, the loss of relatives, or damage to their property.

Secondary victims are those residing within the affected area, or on the border of the affected area, who suffer economic loss due to the disaster or to actions resulting from relief operations.

Tertiary victims are those who are indirectly affected, who live in the same country but not necessarily in the disaster-affected area.

After most disasters, three phases can be identified according to what actually happens in the affected community: the emergency phase, the transitional phase (rehabilitation phase) and reconstruction.

The emergency phase is characterized by actions that are necessary to save lives. They include search and rescue, first aid, emergency medical assistance, restoration of emergency communication and transportation networks, and in some cases, evacuation from areas still vulnerable to future disaster.

The transitional phase initially include people's returning to work and the permanent repair of infrastructure, repair of damaged buildings, and other actions necessary to help the community return to normal as quickly as possible.



Fig.3- Unprecedented sudden impact



Fig.4- Relief and rehabilitation phase



Fig.5- Temporary settlements

Reconstruction is characterized by the physical reordering of the community and the physical environment. Disasters have a potential to introduce change and to improve the society during the reconstruction period.



Fig.6- Return to the normal life with permanent

Often after a disaster, there is a possibility of rebuilding a model society, while recovering victims. Recovery means, returning to normal, and normal usually means whatever existed before the disaster.⁴



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⁴ Frederic, C.C (1983), *Disaster and Development*, New York: Oxford University Press,
New York, p- 34



1.2- Physical, Social and psychological Impact of the natural Disaster

Disasters have claimed countless lives and caused enormous damage through out the history. Even now human livelihoods continue to be threatened by the ferocity of nature in various forms of disasters.

Natural disaster can have any number of combinations of four effects: destruction and damage to homes and buildings; decreased quantity or quality of water supplies; destruction of crops and the presence of unburied human bodies or animal carcasses.

The environmental effects vary considerably from disaster to disaster. Impact of natural disasters on man, direct and indirect could be generally classified in to physical social and psychological impact.

Physical and Social Impact

Other than loss of lives, natural disaster can suddenly damage or destroy personal belongings, shelters, important parts of housing or houses as a ^{whole} ~~hole~~, and basic infrastructure production facilities at personal level and damage places of worship, educational institutions, and other community buildings at a macro level of the society.

Disasters often highlight the social struggles in a society and underscore the inherent inequities within a political system. Earthquakes for an example, effect a high percentage of the poor in developing countries, for it is they who live in unreinforced, poorly built structures, often located on marginal lands.

When the disaster strikes, large formal organizations are most disrupted, there is often a breakdown of clear lines of authority.

During the initial stages of disaster, almost all surface means of transportation within a community are disrupted. This can cause restriction of the emergency vehicle.

Psychological Impact

Other than these factors, there is also something called the loss of “community based belongings”.

This is a social and psychological impact, caused by the physical loss, as the structure of the social



Fig.7- Psychological pain due to loss of life and belongings

life, culture, identity of people are the outcome of the entire physical and non physical belongings of the people of the community which affected by the disaster.

Psychological impact could be of many individual reasons, or a collection of many. Loss of life of a member of the immediate family, relatives, friends, could be one, a psychological pain that no one could get over easily. Loss or damage to the house or the shelter, which is vary personal to man, cause a great psychological impact on him. Many people cannot understand why this happened to them and many of them get used to Drugs/ Alcohol.

Economical Impact

Disasters disrupt rather than destroy the economy of the country. During an emergency, people have to do their jobs and devote their time to disaster related activities, such as search and rescue, or to caring for survivors. During this period normal economic activities are severely curtailed, even if the sources of employment are unaffected by the disaster.



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This period is short-lives, however, and in the later phases of a disaster Economic activities quickly assume a high priority for both business and victims alike. It is important to concern the impact of natural disasters of the people who participate only marginally in the economy such as farmers and fishermen; as the disasters can wipeout not only their investments but also their savings.

Each type of natural disaster has its own effects on land values. Normally land value is increased in urban areas. This is because of increasing the demand of "safe".

A unique problem often arises after a disaster that is related to land ownership. Relief organizations often distribute reconstruction materials without distinguishing the landowners and tenants.

When disaster strikes a community, the economic systems of the community are also affected. Physical facilities may be destroyed or damaged, and the distribution of goods and services are disrupted.

1.3- Tsunami disaster

The word Tsunami comes from two Japanese word, “tsu” (port or harbour) and “nami” (wave or sea).⁵

Sri lankan history has recorded two Tsunamis; one in the legend of Viharamaha Devi; and the other after the 1883 Krakatoa eruption.

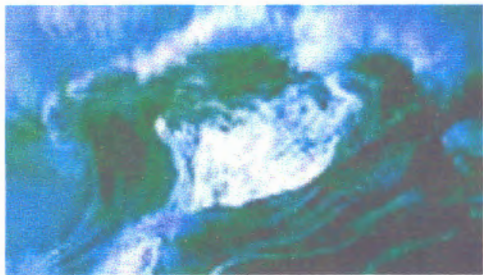
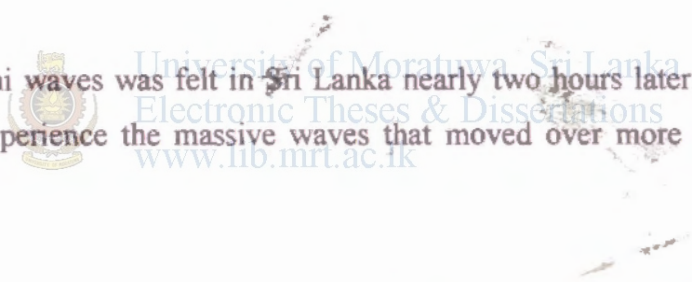


Fig.8- Tsunami tidal waves

In addition, small tidal waves produce in off Sumatra hit the east coast every few years and cause minor damage to boats, although they usually don’t kill any one.

On Sunday, 26th December 2004, massive earthquake measuring 9.0 on the Richter scale was recorded at 7.58 am, near the Andaman island of Sumatra. It caused triggered tsunami waves.

The effect of the Tsunami waves was felt in Sri Lanka nearly two hours later. The east coast was the first to experience the massive waves that moved over more than 2km inland in some area.



The southern coast and part of the western coast were also devastated by this natural disaster. The wave surge was recorded at between 5 and 6.5 meters in most of the eastern and northeastern coast, and parts of the southern coast, doing most damage up to 3 meters above mean sea level.

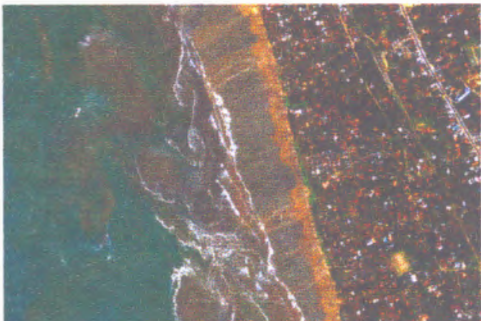


Fig.9- Tsunami tidal waves on Kalutara beach

⁵ Smith, K. (1991), *Environmental Hazards*, London: Routledge, New fetter lane, London, p- 28

A secondary wave struck approximately 20 minutes later. The complex interaction between water-borne energy, sea-bed and terrestrial terrain meant that the effects of the tsunami were different from place to place, but in general the eastern, north-eastern and south-eastern coast of Sri Lanka was particularly hard hit. Overall, the tsunami affected two-thirds of the coastline of Sri Lanka, over 1,000 kilometers in total.

The destruction was un-presented, the souls of human lives snuffed-out so cruelly, so quickly. It caused a drastic impact to the built environment. Piles of rubble, besides gaping holes in buildings, concrete columns and beams entangled, roofs tumbled....



During that time, between 31,000 and 37,000 people were killed by drowning or debris impact, and nearly 80,000 houses were destroyed along with tens of thousands of vehicles and much infrastructure.



Fig. 10- Destruction of buildings.

About 27,000 fatalities were fishermen, and two-thirds of the nation's fishing boats were wrecked, destroying many jobs.

Farming was affected by the flow of large amounts of salt water and marine sediment to fields and wells.

Tourism was suspended in the middle of its peak season, and many coastal hotel rooms were destroyed and additional jobs were lost.



Fig.11- Water in the Triton Hotel



1.4- Impact of Tsunami Disaster in Sri Lanka

1.4.1- Environmental Impact

Sri Lanka has a coastline of approximately 1,660 kilometers (the range reported is 1,585–1,730 kilometers). The coastal zone is very diverse, and contains lagoons and estuaries, fringing and offshore reefs, mangrove swamps, sea grass beds, salt marshes, beaches, sand spits, rocky shores and dune systems.

Sri Lanka's coastal zone areas such as south and southwest Kapparatota-Weligama, Polhena, Unawatuna, Hikkaduwa and Rumassala, and at one site in the east Dutch Bay, Trincomalee contains very productive ecosystems that sustain a large proportion of the country's people and flora and fauna.

Trincomalee was almost exactly due east of the central part of the tsunami disturbance. Prior to the tsunami, Dutch Bay coral reefs had been virtually destroyed. Extreme mechanical damage, with nearly half of the coral reef area ripped off, including the reef base (limestone substrate) in some places, turning the reef into fields of rubble and sand.

The Three quarters or more of the Remainder of southern reef margin has also been severely damaged.



Fig. 12- Coral reef



Fig. 13- Damaged Yala



Fig. 14- Damaged Kirinda

Severe damage on the coast was observed where coral mining in the sea had been rampant in the past.

There were signs of absorbed impact and less damage in locations with healthier vegetation and less disturbed ecosystems. Thlwatta, peraliya area in Galle district had drastic impact of Tsunami, because that particular reason.

The channels in the lagoon mouth have been deepened by the tsunami. The six canals connected to the lagoon have been blocked by debris. The beaches have been polluted with debris and rubbish. There has been little damage to coastal vegetation such as mangroves.

The sand dunes in Morawalla, Sethapaduwa and Thalahena have been damaged. In some places these dunes used to be about 15 meters high but now have been eroded. Coastal vegetation on the dunes has been affected.

At Yala and Bundala National Parks, vegetated coastal sand dunes completely stopped the tsunami, which only able to enter where the dune line was broken by river outlets. At one outlet in Yala National Park considerable damage was done to park facilities (with a number of human deaths) as well as to forest and grassland, with many trees uprooted and the vegetation largely dead and brown.

Two other sites in the park had damage up to 1.3 kilometers inland in flat areas. Some of the areas have been protected, because of the natural sand Dunes.

1.4.2- Social and Cultural Impact

Densely populated pockets of human settlements in the East coast have been completely washed in to the sea without leaving any trace. The towns on the South and South Western coast of the Island are developed very close to the sea front.

Hambantota, Matara, Galle and Hikkaduwa urban areas were devastated. The majority affected in the North-East are Tamils; in the East the Muslims and in the south the Sinhalese.

Province	No. of families displaced	no. of deaths	no. of missing people	Houses completely damaged	Houses partially damaged
Northern	18,,956	6,200	1093	10,734	5,964
Eastern	40,270	14,354	2246	50,990	16,059
Southern	12,503	10,058	2130	10,190	13,369
Western	8,074	341	172	6,470	5,633
North-western	18	04	03	23	72
Total	79,821	30,957	5,644	78,407	41,097

Most of the housing settlements damaged along the coast were developed over long period of time.They represent distinctive regional characteristics in the built form stemming from the responses to different climatic forces, available construction materials and more importantly to the socio-economic requirements of the occupants. They possessed identities, not only according to their region, but also their religion.

Hikkaduwa, Thlwatta, Peraliya in Galle district have faced drastic damage due to Tsunami, as a result of ripping off corral reef. Tsunami Tidal waves overwhelmed a passenger train in Thelwatta area, Killing 1500 people.



Fig. 15- Peraliya Temple



Fig. 16- Destroyed Hindu Temple in Ampara

1.4.3- Economical Impact

The families with different socio – economic backgrounds were affected by the tsunami disaster.

But a major proportion of the affected were engaged in fishing and informal sector economic activities, such as trading in fairs, selling of fish, running a small boutiques and working in near by townships as unskilled labor.

The females are engaged in household work. Some earn an extra income through self employed home based production activities. These include the manufacture of coir products, sewing etc.

Their level of education was low and most of them have barely completed the secondary school.

They lack skills to practice any other vocation. As a result they do not have access to other types of employments.

The agricultural sector has been adversely affected by the aftermath of the tsunami. 259 hectares of paddy land along the coast were destroyed. Furthermore, the paddy lands which were flooded with salt water cannot be used for cultivation due to the salinity of the soil.

Large numbers of agricultural machinery have been destroyed and canals and drains have been blocked. Wells have also been flooded with salt water.



Fig. 17- Fisherman with his single day boat



Fig. 18- Destroyed boat

Many hotels were damaged as well. Hotels along the southern coast were packed with both foreign tourists and Sri Lankans making use of the long Christmas weekend.



Fig.19- Flooded entrance of Blue water hotel

For the many indigenous fishermen and for the fishing industry as a whole, the tsunami spells more than just a natural disaster.

These fishermen, most of whom have no other skills, can no longer depend on fishing as a means of survival for the time being. The fish stock has been depleted, as would the fishermen's money.



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Also, the many of the fishermen's families would have lost their sole breadwinners, together with the fishing boats and equipment, adding on to their already heightening problems.

The towns on the South and South Western coast of the Island are developed very close to the sea front.

1.5- Impact on the Built Environment

The impact of natural disaster can happen in two ways, one could be the direct impact, the destruction of buildings and the component of the fabric of the built environment of man.

The other one is it could be due to a disaster that had occurred in a certain place, the temporary and permanent mitigation of the people from their homes, neighborhoods and from places which they belong to other places too, create an impact on the built environment.

Tsunami disaster inflicts drastic impact on man, also in terms of destruction to the built environment of Sri Lanka.



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Most of the eastern and northeastern coast and parts of the southern coast had most damaged to the buildings up to 3 meters above mean sea level, nearly 100,000 houses destroying.

A number of factors increased the vulnerability of human settlements to the tsunami in Sri Lanka.

Among them are the historical absence of building standards, construction that was uninfluenced by a tradition of risk aversion because of a perceived absence of major natural disasters, a lack of city planning and zoning regulations, and a result of haphazard pattern of construction.

Most of the coastal belt dwellers are fishermen. They have strong relationship with the sea. The worst effects of the tsunami were experienced by people living in weakly-constructed and unplanned settlements close to the shore.



Fig. 20- Drastic Impact on Kalmunai beach



Fig. 21- Unplanned settlements close to the beach



Around 12 per cent of all building units in Sri Lanka were located in administrative divisions along the Sri Lankan coast that were affected by the tsunami. Most houses were owner-occupier, with only 13 per cent of houses occupied by tenants.

A typical house in the coastal zone of Sri Lanka has a single-floor, on-ground structure with shallow foundations, cement and burnt-brick walls, and wooden roof supports under tiles or 'cement asbestos' roofing sheets.

Most had some form of a septic tank, an electricity connection and access to some form of protected or safe drinking water. There were many more dwellings, with unfinished floors, wattle and daub, plank or palm leaf walls, and simple roofing, without in-house toilets, water and/or electricity.

Within about 500 meters of the coast, the tsunami destroyed 99,500 houses and damaged another 46,300, a total of 13 per cent of the entire housing stock of the coastal divisions of the affected districts.

In addition, the destruction of public buildings means the loss of legal records, mortgages and other details. Small market places (*pola*) and grocery shops have been destroyed, also the Damaged cottage cement industries too cannot satisfy demand.

Majority of major towns have been developed along the coast. Galle, Sri Lanka, is one of the examples for that. Debris can be seen everywhere in downtown Galle, where small shops were reduced to rubble by the tsunami. The extent of debris, particularly from destroyed buildings, is enormous.

Little damage was caused to large-scale manufacturing industry since very few industrial facilities were located in the affected area. A large number of home-based production and income generating activities have been destroyed, however, affecting in particular women and artisans, and reducing family incomes.

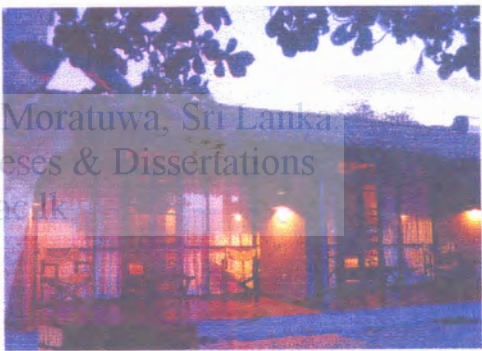
The coastal belt of Sri Lanka is one of the biggest sources of income to the country. The golden shores of the island have been notorious for its natural charm for alluring tourists.

The large impact happens to the resort hotels, and small hotels which were more close to the sea and the rest in unregistered hotels and guesthouses and many small businesses and informal traders catering to the tourism industry, (e.g., dive, souvenir, handicraft shops, and internet cafes) were damaged.



Fig. 22- Triton hotel full of water.

Yala national park is one of the famous eco-tourism parks in Sri Lanka. Hotel Safari Game lodge, Patanangala Tourist bungalow, Patanangala fishing yard badly damaged.



Mahasilawa tourist bungalow was the only protected building, which is protected by the natural sand dunes.

Triton in Ahungalla, Hikkaduwa coral gardens, Blue waters in Wadduwa some of the damaged hotels in coastal belt.



Fig. 23- Yala safari before and after Tsunami

Totally about 2000 hotel rooms were damaged out of 3000 in Galle, matara, Hambanthota and Ampara. It caused large economic loss of Sri Lanka.

Chapter Two:

Examination of Professional and Non-Professional involvement on Resettling Tsunami Victims in Sri Lanka; Case Study

The 2004 Tsunami is widely acknowledged as the largest, most devastating natural catastrophe in the history of the country. Sri Lanka has been extremely hard- hit in terms of loss of life, infrastructure, and economic assets.

Considering the area affected, North, North east and Southern coastal belt was hardly damaged. The country should be re-build again.

It is important to note, that the north and east of the country still suffering from the effects of twenty years of civil war were especially hard hit by the tsunami. Jaffna, kalmunai, baticalloa and Ampara are some of them. A cease-fire has been in effect of the past two and a half years, during which damaged infrastructure, homes, business health facilities and schools were in a process of rebuild. Many of these assets that withstood the war are now destroyed or damaged. Many people remained by war when the tsunami struck, and now must perpetuate their stays in temporary camps and have few prospects for recovery without external assistance. From area to area of this coastal belt the social attitudes differ.

The deviance in sub-cultures are very evident when studying an area, and it is very important to identify these sub cultures and to respect there diverseness. The social attitudes toward a problem differ from one sub culture to another. Their way of life, social characteristics as well as psychological characteristics differ from one another.

There are sub societies, according to the income level as well as according to the cast system, in areas such as Peraliya, Thlwatta, Akurala, and Ratgama. Considering the religious base settlements, there are lot of Buddihist dominated areas as well as Muslims, and tamils. Kirinda in Hmbanthota district is a significant example for religious base settlements.

Instead of that most urban areas have the issue of lack of lands. Most of the people affected by Tsunami, that because they have more close to the sea. The residences are 5 or 10 kilometers close to the sea, in some of the areas, like Kalmunai in Ampara district. But it is not because of the lack of lands. It is according to the life style of them.



Fig. 24- Map of selected case studies.

The attempt of this chapter is, to examine the Architectural aspects on re settling of Tsunami victims, in different areas with different social, economical and cultural background, who has affected by the Tsunami in Sri Lanka.

For this purpose, three affected communities have been taken into consideration.

- 1- Re- Settlement of Kirinda, Hambanthota District in Southern province.
- 2- Re- Settlement of Peraliya, Galle District in Southern province.
- 3- Re- Settlement of Kalmunai, Ampara District in North- east province.

It will examine the historical background, Social Cultural Economical background, of each community, and their general living pattern, and how far it is affected by the tsunami.

Examine the professional involvement of re building, under Immediate and Long term response.

That vision is to make Sri Lanka a much better place than what it was before Tsunami Disaster on the 26th of December 2004, both socially and economically, so that all Sri Lankan, regardless of their economic circumstances, race, ethnicity or religion, can maintain a happy and healthy living standard. But it will arise so many issues according to the social, cultural, and religious background of the people.

Therefore have to consider all the above aspects, while handling the re building projects. Government, NGOs and INGOs have involved in re building projects, all over the affected areas. To successfully complete this purpose, the need of professional involvement is essential.



Case Study 1: Resettlement of Kirinda

2.1.1- Location

The small port of Kirinda is on the south coast of Sri Lanka about 270km from Colombo, 10km south of Tissamaharama.

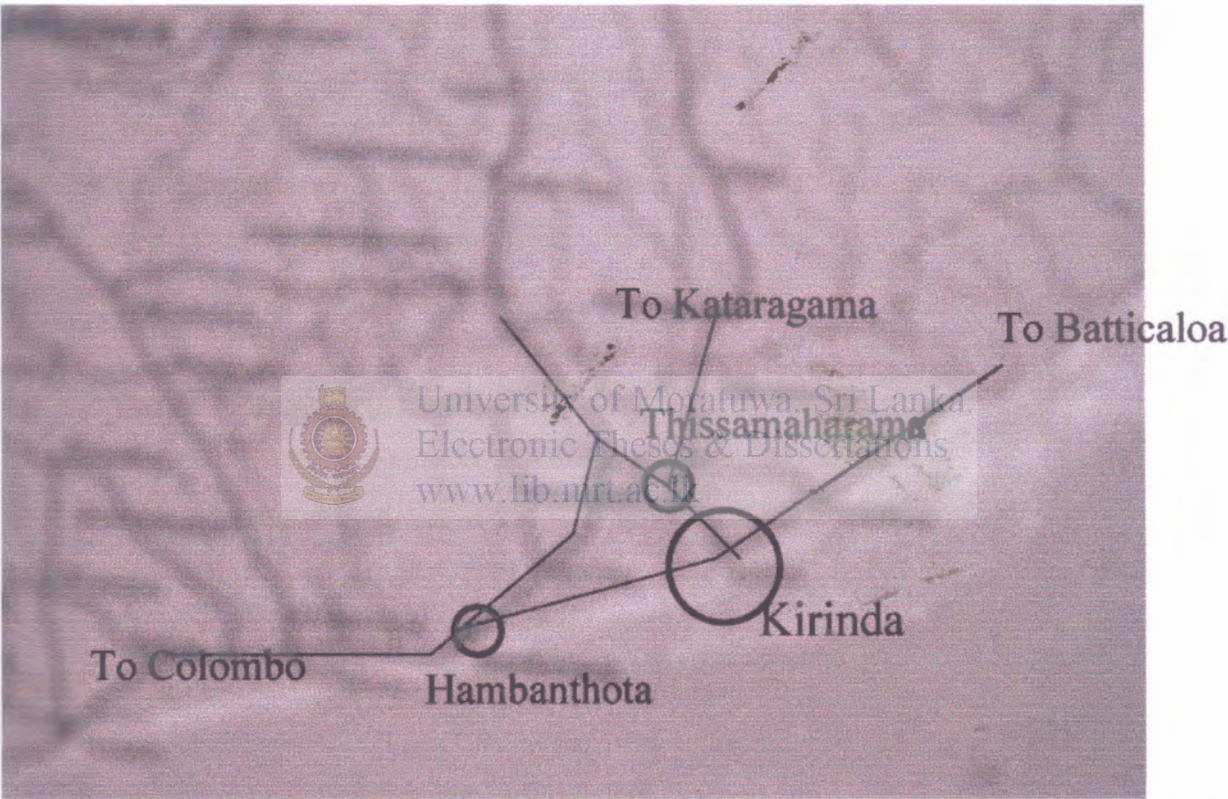


Fig 25- Area Map of Hambanthota

2.1.2- Historical Background

Legend has it that in the second century BC, a king by the name of Kelanithissa had a monk put to death and the gods were annoyed and caused the ocean to flood the land. According to that it was the first Tsunami reached Sri Lanka.



Fig. 26-King Kavantissa scarifies his Daughter to the sea

To overcome with remorse, the king decided to atone for his sacrilegious act by making scarifies of his eldest daughter to the sea. The princess was rescued near Kirinda. Eventually Kavanthissa, the king of the southern region of Sri Lanka married her and named her Viharamaha Devi. The popularity of the legend makes kirinda a focal point for pilgrims and tourists today. It is dominated by the kirinda rock temple a major Buddhist pilgrim site.

2.1.3- Social and Economical background

Kirinda is a harbour town, with the town centre populated predominantly by the Muslims. On the periphery there are a number of Singhalese villages. The town people's main occupation is fishing. The latest income generator is whale watching.



Fig. 27- Kirinda Its scenic beauty...

It is bound on one side by the ocean, And on the other by wetlands, stretching for miles on to Bundala. Its scenic beauty is quite like no other coastal in the south.

Although it is a Muslim town, it is dominated by the major Buddhist pilgrim site. During the Kataragama season, as many as 200 busses come to kirinda every day. The concept of "Wewa, Dagaba, Gama, Pansala" is there.



Fig. 28- "Wewa, Dagaba, Gama, Pansala"

2.1.4- Impact of Tsunami

Today kirinda is one of the most affected towns in Sri Lanka due to the Tsunami.

Damage to the residential areas and the civic centre is extensive. Some 77 houses were destroyed, an unknown number were partially damaged. While the built environment was demolished, the natural environment is existed towards the tidal waves.

Severe damage was happen to the boats, fishing equipments. Approximately 250 families to be provide alternative security measures for boats, equipments and a plan to build an island fish market in order to prevent fishermen from building near the beach.



Fig. 29-Nature is existed

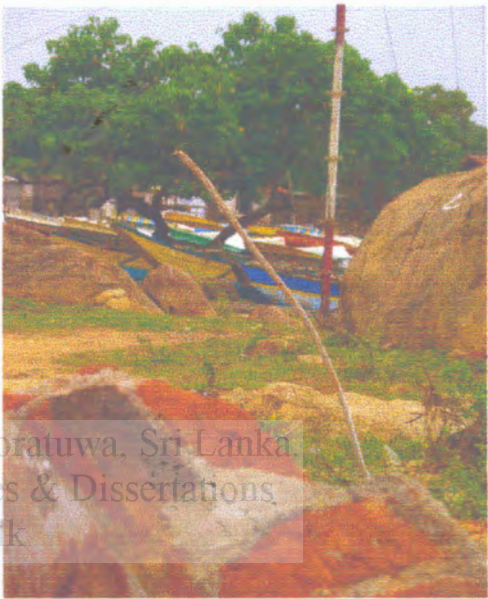


Fig. 30-Distroyed boats



Fig. 32-Distroyed houses



Fig. 31- Destroyed fishing equipments

2.1.5- General living pattern

The most Muslim communities that were affected by the Tsunami were that unlike the Singhalese, the Muslims do not want to be relocated. Being fishermen, having proximity to the sea was an obvious reason, but a history of ethnic tension did contribute to this feeling of insecurity as well.

After interviewing the affected and visiting the ruins of the destroyed houses a type plan was arrived at.

Basically they have large rooms for praying. Kitchen area with court yard is prominent.



Fig. 33- Existing parking for temple

The houses are arranged like clusters, while creating gathering spaces.

Construction materials are cement blocks, GI sheets, Tiles etc.

They have gained water from main water supply and have used grid electricity.



Fig. 34- Electricity system

Tank like public spaces have not functioned, because Muslim community was not bound with the functions relate with the temple and tank also Muslim women do not like to expose to the society.



Fig. 35- Kirinda rock temple and the tank

2.1.6- Resettlement of Kirinda

2.1.6.1- Immediate Responses

Emergency Settlements

During the first two weeks after the Tsunami the affected occupied in safe place on their choice. There was no government or external influence on the selection of this place. So people took refuge in the nearest public buildings. The existing buildings such as schools, preaching halls of Buddhist temples, church buildings and Kovils on high land near the affected areas were occupied.

Kirinda rock temple was the oasis for the people who lived near the temple, because although Tsunami tidal waves have swept the houses they couldn't reach the Temple premises, as it is in a higher position and has covered with rocks.

Considering the affected Muslim community, after destruction their belongings and everything, most of them have moved to their relatives' places. Unity and community participation is highlighted among the Muslim community when they have to face sudden impact.



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The government did not have a stock of the affected at this stage. The food, water and other infrastructure facilities were made available by local volunteer organizations.

After couple of days the government organized an assessment of the damage of the disaster. Initial attention was paid to estimate the number of human deaths and the displaced. Based on the available data, divisional secretariats started to establish refugee camps within two weeks time from the Tsunami. Around 500 persons were provided accommodation in a camp. The dry rations for food were provided to the camps. New temporary sanitary facilities were constructed and the water was supplied through bowsers.

There were two types of camps. One is existing structures such as Kirinda temple, Mosque was used for the camps. Temporary partitioning was done for male and female sections in the building. They are in more organized manner.

Second one was tent structures. Existing playground was used to erect the common tent structures. Several families were allocated in a one. They had common toilets and kitchens.

Temporary Settlements

Understanding the delay in completion of permanent housing, the government decided to erect temporary shelters for the people living in camps. The transitional shelters were constructed by the government agencies as well as by the NGO's. These temporary houses had cemented floors, timber walls, GI sheet roofs and closable door & windows. They are individual houses

2.1.6.2- Long term Responses

The Permanent resettlement

Architecture for Humanity projects has been utilized locally based construction techniques, allowing immediate community participation, and innovative sustainable initiatives to rebuild Kirinda, which has been devastated by the tsunami.

This project will involve the construction of a community hub that will include a school, health clinic, marketplace and public gathering places. This form of architectural acupuncture creates a catalyst by which communities can grow and build - eventually towns and villages will re-emerge.



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The proposed development is based on the prerogatives of maintaining the social and cultural structure of the inhabitants of kirinda, while creating environment and infrastructure which will enhance life in and around the town. This has been achieved in several ways.

Firstly the proposal aims to re house those displaced in roughly the same area in which they lived. This is especially important to Muslim community who are involved in trade and fishing on the area and do not want to move away from the town.

It is also achievable since most of the town is behind the 100km no-build zone set by the urban development authority. Secondly to house the Sinhalese effected in the hinterland.



Proposed resettlement of Muslim community

One of the proposed housing developments for Kirinda is designed by Japanese Architect named Shegaruban. Near the Kirinda rock temple, 25 acres were located for this purpose. An unused tank is going to be functioned. Proposed housing scheme is consisted of 125 houses, play ground, mosque, community hall, pre-school and shop houses.

Layout

The site has a gentle slope, in addition distant views of the sea are also possible from some places. Temple is at the highest point. Public recreational area has been created near the tank as it tends to become a hub of activity in village life.

The houses are on 10 to 15 perch plots and have an internal access road network. 60 houses are scheduled to complete in first stage and other 65 for the second stage. Most of the proposed houses are linearly arranged while facing Thissamaharama main road.

Proposed layout consisted of large area of parking near the kirinda temple and there are shop houses, each 20 or 30 perch plot, which are located other side of the main road, facing to the parking area.

Existing 4.8 acres tank is landscaped and proposed as recreational area for the people as well as for the utility activities, which can give water for the paddy cultivation.

Proposed Mosque is designed by Archt. Shegaruban with community participation.

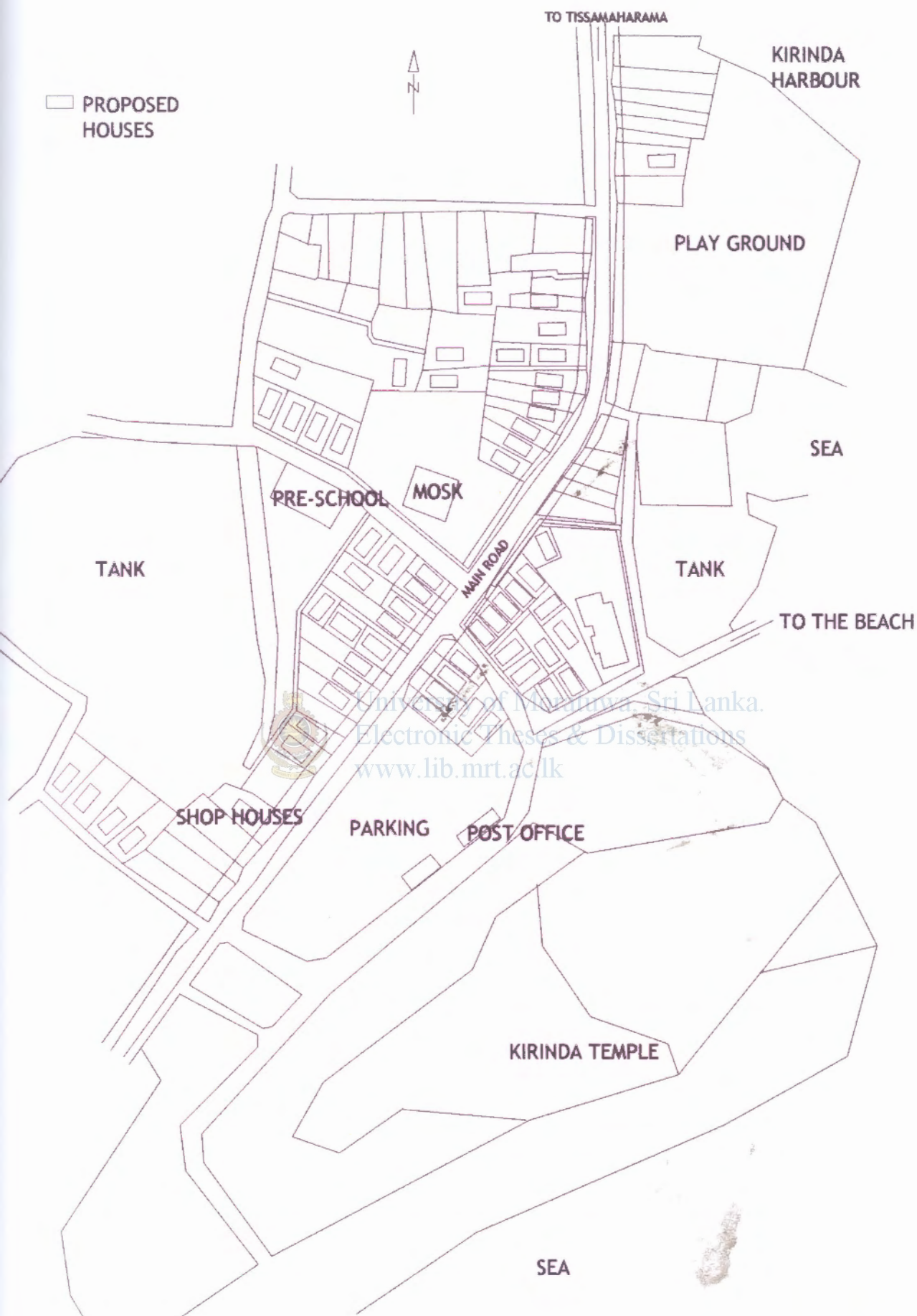


Fig. 36- Layout Plan of Kirinda



Individual unit

Considering the housing unit, one unit consists of two bed rooms, facing the main road, kitchen and toilet is in other side. Open Living space links two parts of the house. It acts as a multi functional space, in between the bed rooms and the kitchen. Living is faced to secondary road. There is a level change between bedrooms and living space.

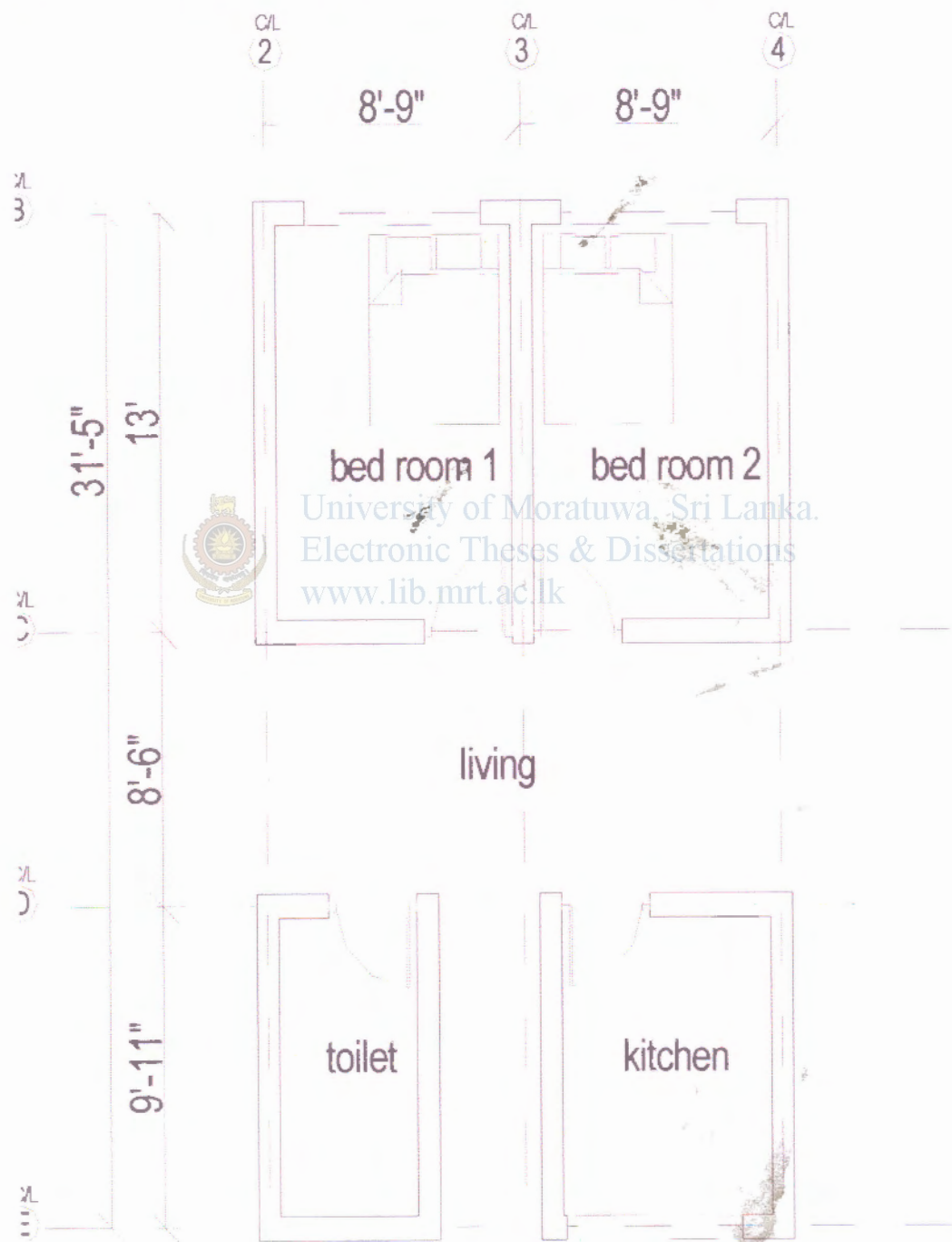


Fig. 37- Individual Unit

Bed rooms have got maximum light and ventilation. Middle open space provide cross ventilation to the whole housing unit.

Considering housing lay out, bedrooms are facing each other. Entrances are made gathering spaces, which is link with the living room.

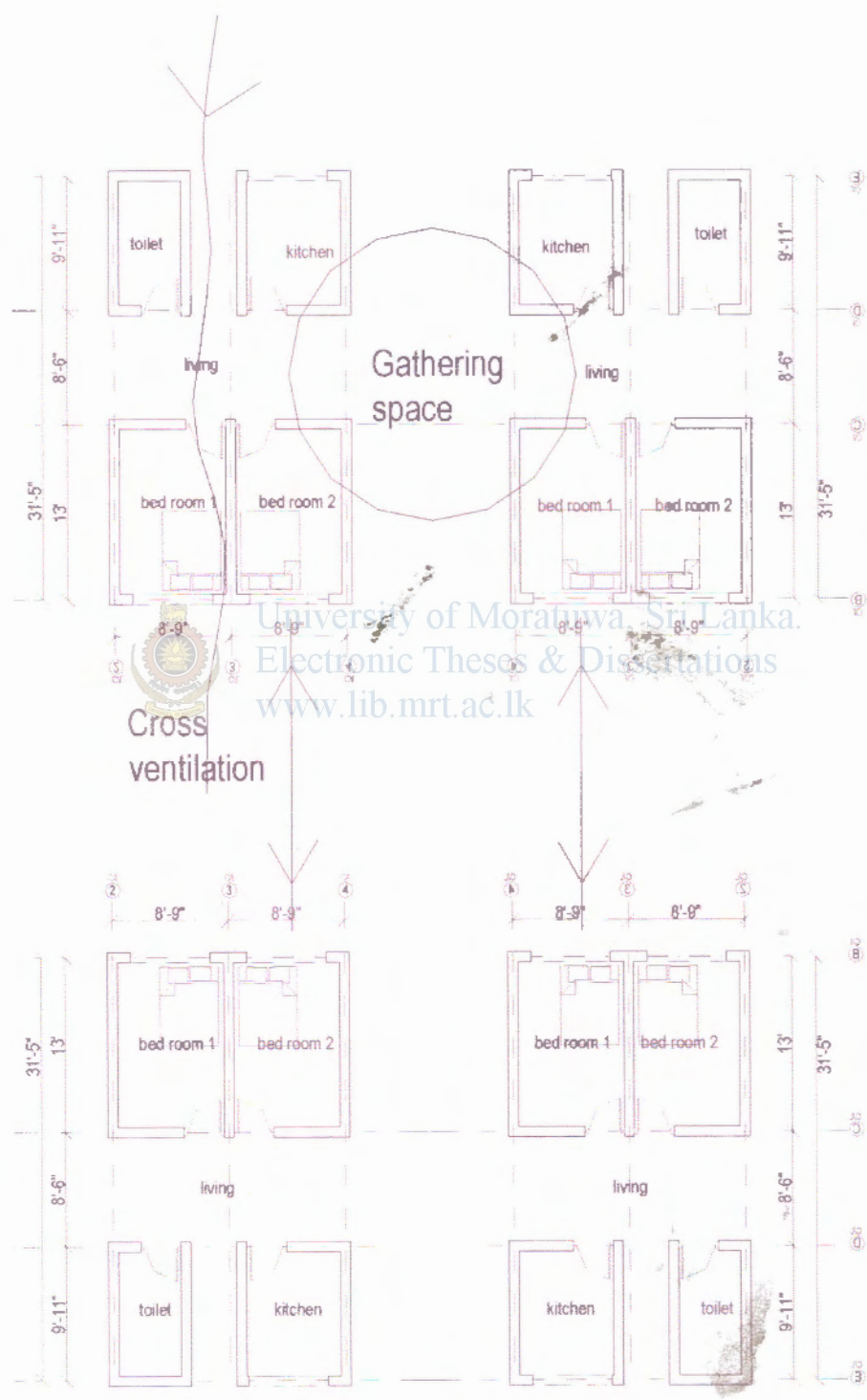


Fig. 38- Housing arrangement

Construction Materials and Technologies

The walls are made out of clay and cement mixed blocks. It is a new building material with less cost because Clay is a available material in that area. Heat gain is less, therefore it reduces the heat in side of the house. It has been finished with Cement rendered floor.

Rough mud colour of the houses is merges with the natural setting.

Roof consisted of first class imported timber with calicut tile cover. Wide span is provided by this roof structure. The cost is high. There is a gap between roof and the wall for the ventilation. Internal courtyard is also reducing the heat. It create comfortable living environment.

There is a community participation, in the construction stage. When the scheme is in same construction stage, they get advantage of Labour efficiency, cost effective, minimum material wastage and easy supervisions. There is a unity among the Muslim community. They contribute to build their own village.

New construction techniques have been introduced.



Fig. 39-clay and cement blocks



Fig. 40- Roof structure



Fig.41- Scheme is in same construction stage



Fig. 42- Clay –cement brick wall

Case Study 2: Resettlement of Peraliya

2.2.1- Location

The village of Peraliya is located around Temple Road off the 95km of Galle Road in Sri Lanka – a three hour drive from the capital Colombo.



Fig.43- Hikkaduwa Area Map

2.2.2 - Social economical and cultural background

Fishing and its related activities are the main income generating systems of them, like coir products.

Paraliya, Hikkaduwa, and Thelwatta area are more familiar because of natural coral reefs. People get benefit from the tourism also. But unfortunately coral mining is also famous among the villages. Younger generation involve in that.



Fig. 44- View of Peraliya

Tsunami waves have come about 2km inter land, because there was no natural barrier. It caused sever damage to the villages like, peraliya, Thelwatta and Hikkaduwa.

Peraliya consists an unplanned development. Most of the people are fishermen and they have built their houses near the beach within the 100m no built zone. But there is an order according to the income level and the cast system.

The low income fishermen have occupy in the beach near the sea, that because of the easy access to the sea. And they want to keep their boats and other fishing equipments close to them.

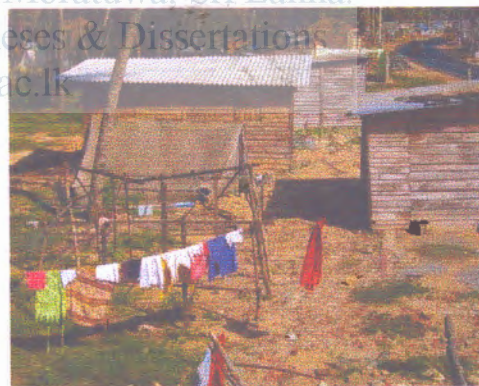


Fig. 45- Wooden houses

Beach is functioned as a public space, which facilitates fishing, selling, and repairing nets and boats etc. Normally the houses are made out of timber and covered with GI sheets or coconut leaves. They have made their own territory using wooden fence.

According to the cast system, there are several sub communities. They have group and live together. Middle income people occupy far from the sea, but some of them are also in 100m zone. Some of them are fishermen, but most of them are involve in another trades. Women have gone abroad and earn money. Younger generation are also involved in tourism base activities.

The people who live near the Peraliya temple is Sinhalese Buddhists. There are Sinhalese Catholic as well as Muslim and Hindu people.

They used to involve in religious activities during the festival season in Seenigama temple.



Fig. 46- Seenigama full moon perahera



Fig. 47- Hindu Dancers



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Tsunami tidal waves did not reach the Peraliya Temple. It would be an oasis for the victims. The temple premises act as a refugee camp.

They have decorated the Temple on the anniversary of in many of loss of lives.

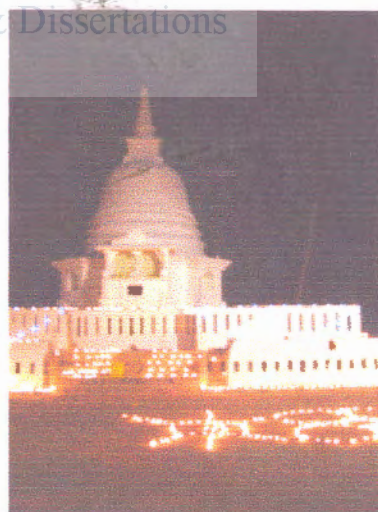


Fig. 48- Peraliya Temple

2.2.3- Impact of Tsunami

Peraliya village in Sri Lanka was almost totally destroyed by the Tsunami waves at 9.26 am on December 26th, 2004.

There were haphazardly developed temporary as well as permanent dwellings along the beach side, because most of them are fishermen.



Fig. 49- community participation

Low income fishermen with their day boats and equipments were completely destroyed.



Fig.50- Destroyed boats

An express train on the Colombo-Galle route was passing through the village at that time. The force of the water swept the train from its tracks, by killing 1468 passengers.



Fig. 51-Train disaster

The village itself lost 500 people, while 200 are still missing. More than 2500 people died in Peraliya, 90 percent of the villagers were destroyed and 450 families were homeless.

Tidal waves washed out the village. Rest of the people suffer deaths of family members, relatives, friends, loss of belongings and their residences.



Fig. 52- Destroyed houses

2.2.4- Resettlement of Peraliya

2.2.4.1- Immediate Responses

Emergency Settlements

Nine days after the Tsunami wave, even though hundreds of pilgrims were visited the train on a daily basis, the villagers had not received any medical aid, nor basic provisions such as food and water. None paid volunteers who started a volunteer revolution along the coast where hundreds of other volunteers later followed and came to work at Peraliya.

The new volunteers started their own camps. The whole region grew with thousands of independent volunteers which is still strong today.

Immediately victims moved to public buildings like temple, community hall and etc. There was lack of medicine, food, cloths and other utilities. People gathered in public buildings.

Japan, Australia, USA are the volunteer foreign countries, who help in relief work as well as rebuilding affected communities.

In the emergency phase, each family got a tent. They occupied near their destroyed home.



Fig. 53- Relief works in camps



Fig. 54- Queue for food, cloths and etc.



Fig. 55- Tents from Japan



Fig. 56- Tents from Australia

Villagers and a group of independent volunteers have begun the very slow rebuilding project. Therefore the emergency phase is long.

They built temporary tent structures to locate Pre-school, School and Hospital for the essential requirements.

Temporary Settlements

In the Transitional phase, wooden raw houses, Pre School and school are provided. The people of the Peraliya, have live long time there, because permanent house have taken long time to construct.



Fig. 57- First mobile Hospital



Fig. 58- Construction of wooden houses



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Fig. 59- Wooden school

There are very slow rebuilding process. Still the debris and destroyed boats are remaining near the temporary houses.



Fig. 60- Slow construction process



2.2.4.2- Long term Responses

The Permanent resettlement

The aim of Resettling Peraliya victims is to directly help the people of Peraliya in the long-term rebuilding project of their village. Project include a medical centre and school, construction, rehabilitation programmers, trauma relief and the setting up of school trust funds for the village children.

In the existing situation, there were unauthorized buildings in between rail way line and the Galle road. Tsunami tidal waves have destroyed all the built structures, except some of the houses and the library building of the school. Still there are some wooden structures. They don't like to move even they have given permanent housing.



Fig. 61- Peraliya Area map

Resettlement Peraliya

Considering Peraliya, there are professional as well as non professional involvements. New housing construction programs are also conducted by both parties.

Proposed housing development is for the Sinhalese fishing community, by Archt. Justin and his foreign Professional team. Which is located inland near the railway line.

According to the new layout, there is a coastal conservation belt, to protect coral reef. And beach recreation is promoted. It will be additional income generating system in tourism. Government has proposed 100m no built area as recreational zone.

Low income fishermen have been located near the beach but not closer. There is a considerable distance. The houses are linearly arranged facing the road. Middle income community is located far back from the beach, closer to the temple. Play ground is located near the temple act as public gathering space.

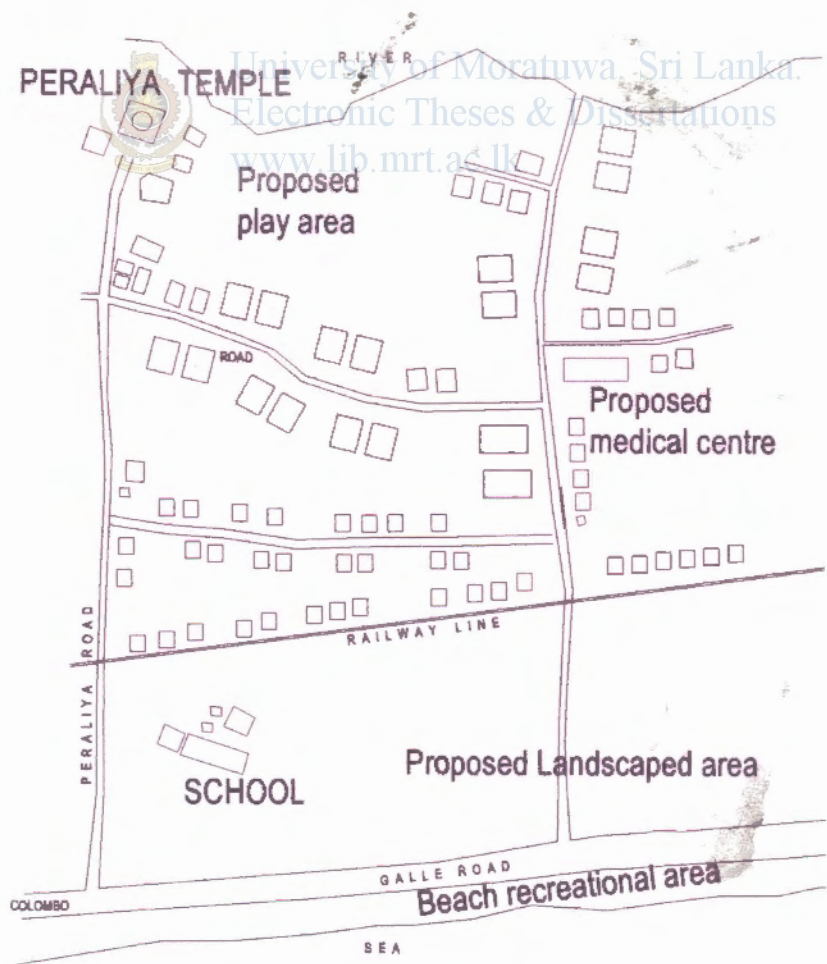


Fig. 62- Proposed resettlement

Individual Unit

Individual Unit consist of 9'6"X8'9" two bed rooms, Living/ dining, Kitchen and attached Bath room. Each bed room faces towards front and rear of the unit. Thus it Provides cross ventilation through the unit.

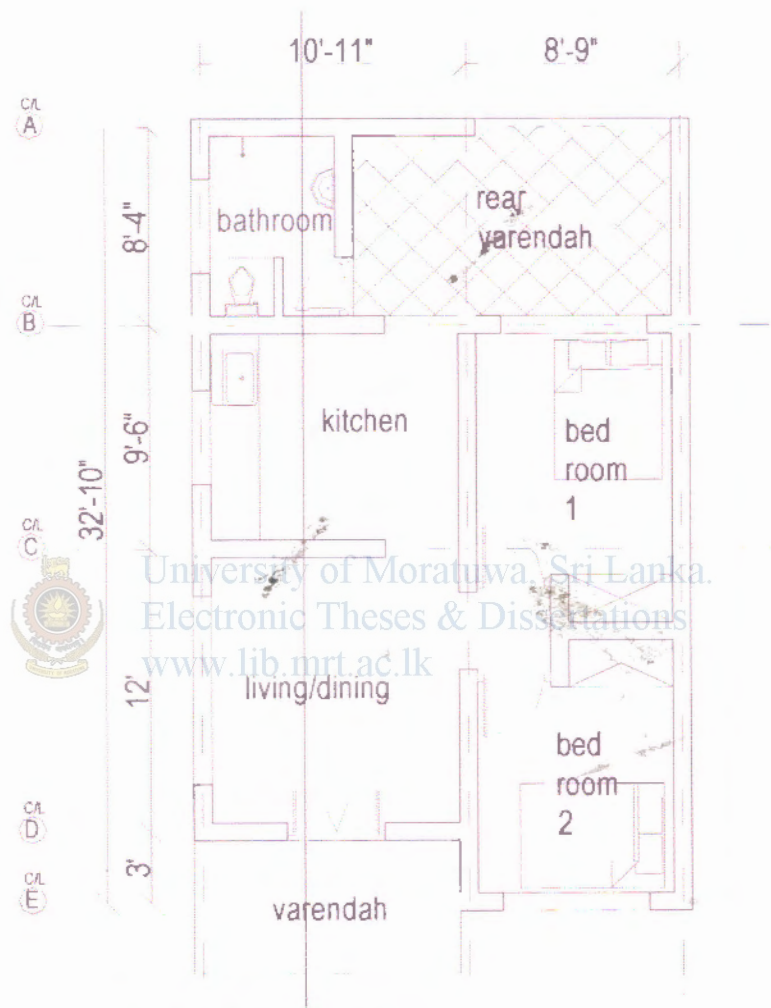


Fig. 63- Plan of one unit

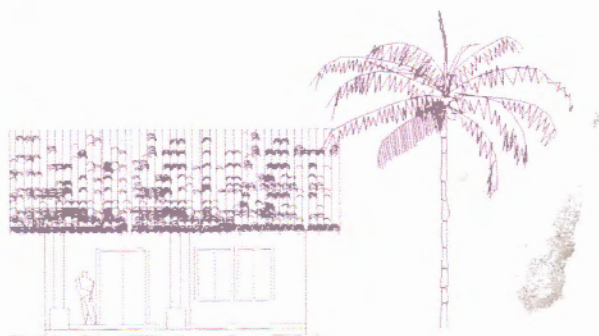


Fig. 64- Front elevation

Considering the Cluster settlement, each unit in 6 perch plot. Floor area is around 600 sq ft or 650 sq ft. So it reduces the garden space. To avoid that issue, the architect has located the unit closer to one boundary providing blind wall there. It creates large garden space with the neighbour. It acts as workable gathering space which creates sense of community.

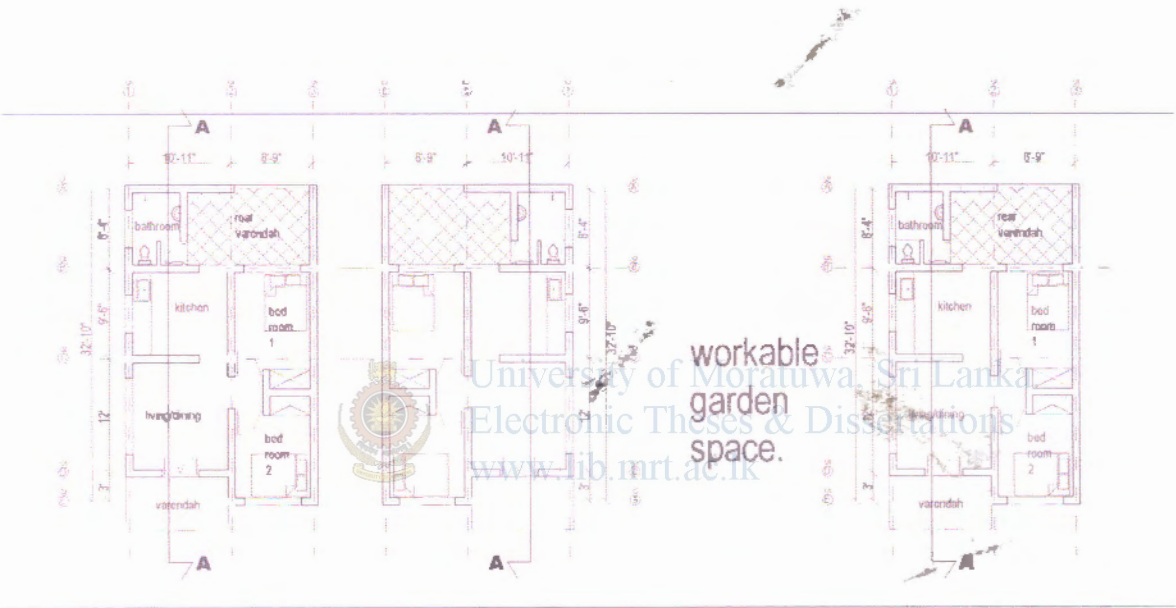


Fig. 65- Cluster Layout

While the living space is extended with the front verandah, kitchen is extended with the rear verandah. Single pitched roof is covered with calicut tiles.

Wide windows provide maximum light and ventilation. Front verandah acts as multifunctional space.

Still they use their temporary wooden houses.

Permanent houses are arranged as clusters, while creating narrow pathways in between the houses.

New houses at Peraliya were donated by foreign donors to the honorable Jejaraj Fernandopulle, minister of commercial and trade. Dr. Stein, one of the foreign NGO donors and his Architect Justin designed the new medical center at Peraliya, and it is at the construction stage.



Fig. 66- wooden houses in front of the Permanent houses.



Fig. 67- The housing scheme



Fig.68- Medical centre at under construction

Construction materials.

Houses are made out of cement blocks and plastered and painted. Roof structure is made out of coconut rafters and covered with calicut tiles. Pre cast columns have been used. Debris are also used in construction that taken from the area.

Case Study 3: Resettlement of Kalmunai

2.3.1- Location

Kalmunai is located at Ampara district,in North east province.

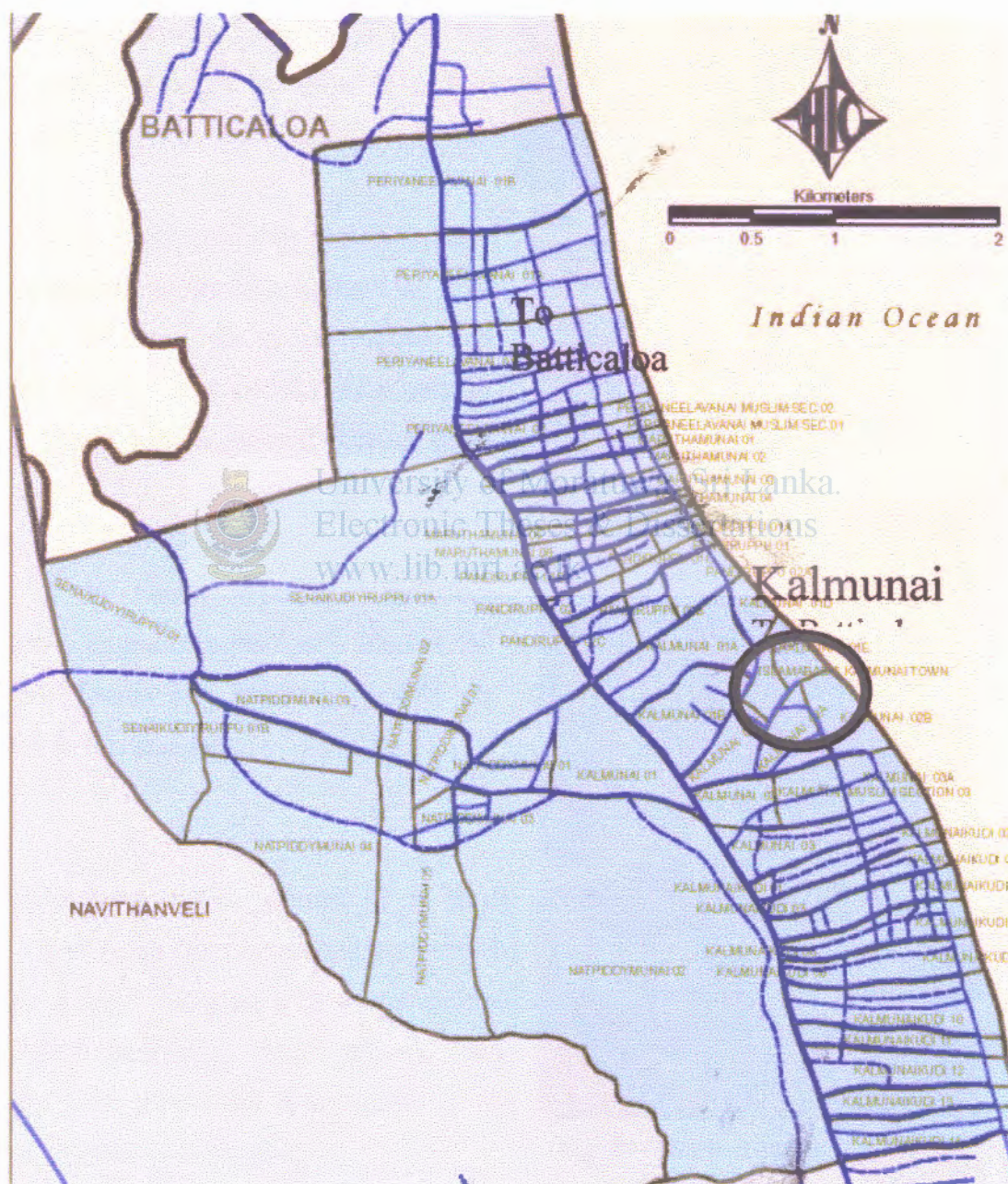


Fig 69- Area Map, Kalmunai

2.3.2- Social, Cultural and Economical background

It has its significant identity in geography and climate. The landscape is tropical and lush. Palm trees with yellow coconuts abound. Everywhere there is vegetation.

In places where the jungle has been cleared there are rice paddies. In some places there are stakes in the ground with string around the stakes and pieces of white cloth fluttering on the string. Stenciled in red on the strips of cloth is "caution land minds" in both English and Tamil.



Fig. 70- Abandon house in a paddy field

North east is a multy religious province. Each little town has its own Buddha, through the trees sitting on a hill above the town. Another was just beside the road on a pedestal base perhaps four feet square with the seated Buddha about six feet tall.



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Because of the twenty years war, Sinhalese population is migrates to the south. Most of the people are Tamils and Muslims. Tamils are dominated in this area now.

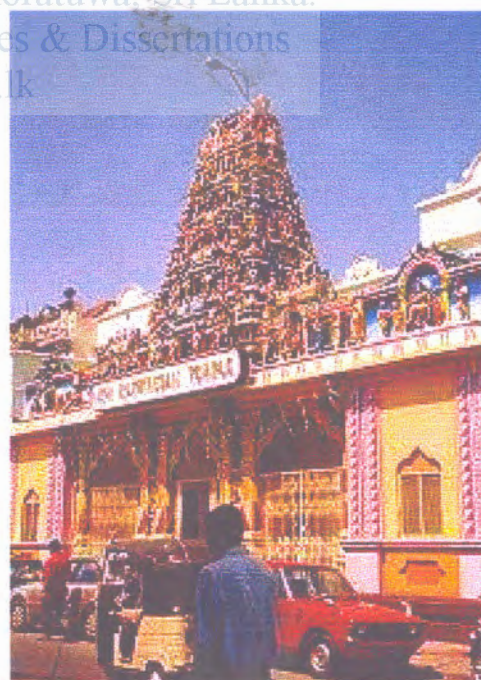


Fig. 71- Hindu Temple

Most towns have Hindu shrines or a Hindu temple. These range from crumbling gray cement Ganeshes to more elaborate affairs with multiple Hindu deities painted in bright colours. Some towns also have a mosque, recognizable by the domes on an otherwise flat roof.

2.3.3- General Living pattern

Kalmunai is affected by 20 years war. Because of that, their lifestyle is more restricted. After the case-fire, they were in process of rebuilt, but normally their residences are temporary structures which are covered with palm trees, because still they are having dark memories of past war experience.

Some of them are in camps. They do not like to move to their original homes, because of the bad memories of past war experience. Their lives are protected in camps. Their lifestyle is temporary, risky, but simple.

Fishing and its related activities are the main income generated method in the coastal belt of the north east also.

They have built temporary structures with palm leaves, more close to the sea, 5 or 10 meters near the beach. "Pila" is used for some of the activities like repairing nets and it is the gathering space for the people which act as living area.

Schools are also temporary structures, located in an open space just covered with palm leaves roof. Wind and rain effect are there. The children learn to withstand in natural hazards since their childhood, because the impact of man maid disaster is drastic more than that.



Fig. 72- Raw house in the beach covered with coconut and palm leaves



Fig. 73- "Pila" in front of a fisherman house



Fig. 74- Day school

Although the life is unsure and temporary, human territory is there. They have demarcated their own land, using fence.



Fig. 75- Making own territory

People use temporary well, just covered by palm leaves. Water reflects the hardness of the life.

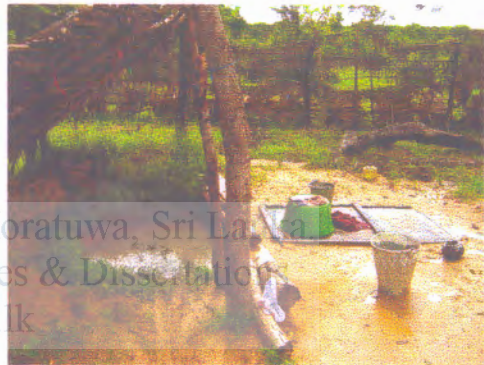


Fig. 76- Covered well

Population is less in remote villages. No proper road net work. Because of the terrorists attacks are not concerned development projects.



Fig. 77- remote village

2.3.4- Impact of Tsunami

Kalmunai, a collection of fishing villages in eastern Sri Lanka, was one of the area hurt mostly by the tsunami. Of the 35,000 Sri Lankans who died in the tsunami, more than half died in Kalmunai and surrounding villages in Ampara. The tsunami destroyed more than 14,700 homes and displaced nearly 100,000 people.

Fishing industry is completely destroyed, because the life style of the fishermen was hardly bound by the sea and their lives were in the beach more close to the sea.

Some of the houses are permanent but most of them are temporary structures. Because of that, they have faced severe damage of loss of lives, loss of belongings and loss of dwelling places. Already damaged Infrastructure facilities were completely demolished by the tidal waves.

The pre-disaster situation in the north and east gives some perspectives to the additional burden the tsunami has placed on the population. Before the tsunami struck, the employment rate was estimated to be double the national average.

The beginning of 2002, over 40000 families till live in the relief camps and more than 350000 houses needed to be reconstructed with regarding war disaster.

Given these circumstances, the recovery needs of the north and east require particular focus.



Fig.78-Damaged fishing industry



Fig. 79- Debris allover the beach

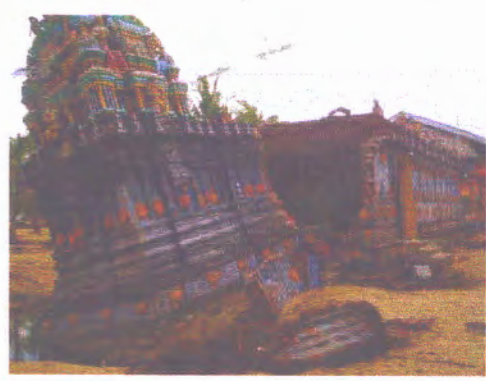


Fig. 80- Damaged Hindu Shrine



Fig. 81- Damaged infrastructure

2.3.5- Resettlement of Kalmunai

2.3.5.1- Immediate Responses

Emergency Settlements

After the hard hit by Tsunami, most of them are relocated to refugee camps. There was no government or external influence on the selection of this place.

The people took refuge in the nearest public buildings and the places of religious worship. Most of them are Mosques and Hindu Temple. Food, Water and other sanitary facilities are provided by the relief workers.



Fig. 82- Refugee camp

The government through its divisional and district level administrative network organized an assessment of the damage of the disaster. Initial attention was paid to estimate the number of human deaths and the displaced.

Based on the available data divisional secretariats started to establish refuge camps within two weeks time from the Tsunami. Around 500 people were provided accommodation in a camp. The dry rations for food were provided to the camps. New temporary sanitary facilities were constructed and the water was supplied through bowzers

The camps were of two types;

Existing structures such as temples, churches, Mosques and Kovils were used for the camps. Temporary partitioning was done for male and female sections in the building.

Some of the buildings which were occupied during the emergency phase were also used for camps but in a more organized manner.

In situations where such large public buildings were not available for the people, individual tent structures were erected in open lands such as in play grounds etc by the relief workers, as well as government.

Each family given individual tent structures. The camps for the immediate resettlement had common toilets and common kitchens.

Basically in North east province one long tent is for several families, because in Muslim communities several families live together.



Fig. 83- Tent structures

Immediate resettlement hardly provided opportunity for the affected to shape their shelters. They were in a state of shock and primarily concerned about the food and water. But most of them openly showed their dislike to the tent structures.

Temporary Settlements

Understanding the delay in completion of permanent housing, the government decided to erect temporary shelters for the people living in camps.

The transitional shelters were constructed by the government agencies as well as by the NGO's. The units were constructed on Government lands.

These temporary houses were made out of timber walls, palm leave roofs with eaves, closable door and windows. Basically they are raw houses. The common cooking spaces were provided in the rear side.

The movement from the camps to the transitional shelters marked a major change of the living environment for the affected.



Fig. 84- Transitional Raw houses

The transitional house has the options in the decision making process of the affected. They have certain degree of authority to modify their living environment.

Although the transitional houses have increased the options of living, they create problems in other hand. It was basically not considering the climatic and geographical conditions of the country, because most of the resettlement projects have been conducted by foreign NGOs.

Because of that most of the people come back to the beach and built temporary houses with available materials again. It is easy to build and maintain.



Fig. 85- back to the normal life

2.3.5.2- Long term Responses

The Permanent resettlement

The affected had to be relocated from their original settlements. The identified lands for the new settlements are located at a considerable distance away from the original places where they were. The government decided to keep a 100 meter reservation along the coast.

Living away from the sea affects the livelihood of the fishing community. Majority of fisher folk want to launch the sea journey from the harbour or the place of anchorage they are used to.

The new housing schemes are constructed by NGO's and INGO's. GOAL, Red Cross and Tab Relief mostly involved in this purpose. Some of the affected communities haven't chance to take part in the decision making process at the design stage due to the urgency of the task.

According to the government decision, each family, who has affected by the Tsunami gets 500sqft house as their permanent resident. Finding lands are not a critical issue in this area. Government lands are allocated for this purpose. Most of the lands are close to the sea. Infrastructure facilities are provided.

The north and east require particular focus to uplift the life style of the people who live in such an uncertain area.

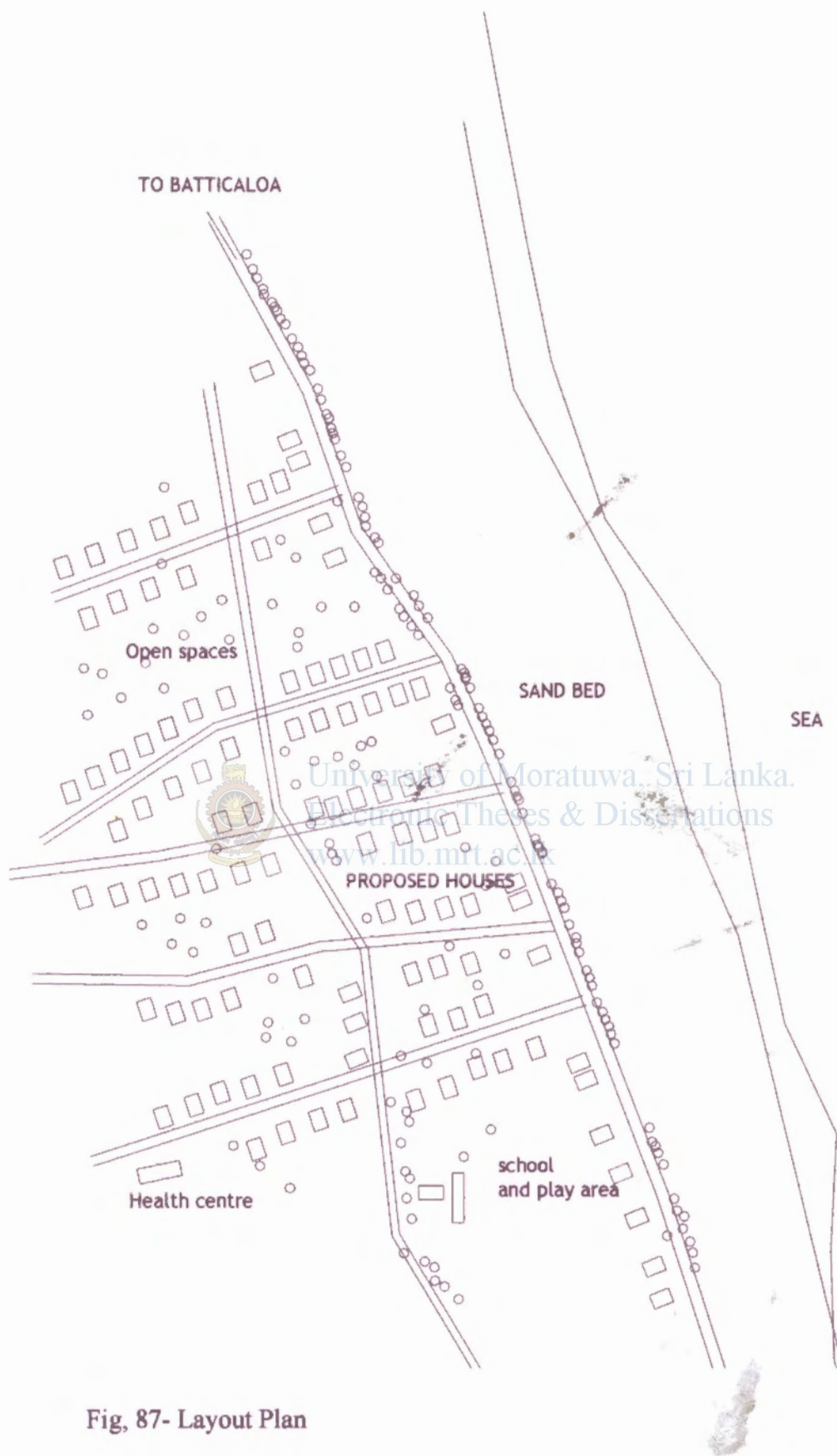
proposed resettlement for fishing community

Proposed housing development for fishing community of Kalmunai is designed and constructed by NGO named Tab Relief.

The lay out of the housing schemes is generally geometrical. Designated areas have been provided for common activities such as community centres, play grounds, pre schools etc, which facilitate their lifestyle. Roads and pedestrian paths lead down to the sea.



Fig. 86- Geometrical layout



Fig, 87- Layout Plan

Individual units

After studying the general social and economical aspects of the victims, has identified two type plans for the housing unit, consist of two or one bed rooms, living, kitchen and toilet. Generally one unit has 500sq.ft. floor area.

One is face to the main road with a veranda. Toilet is detached but close to the house. There is single bed room, and large space is function as living and dining room. Detached toilet has temporary roof cover.



Fig. 88- Typical house with verandah

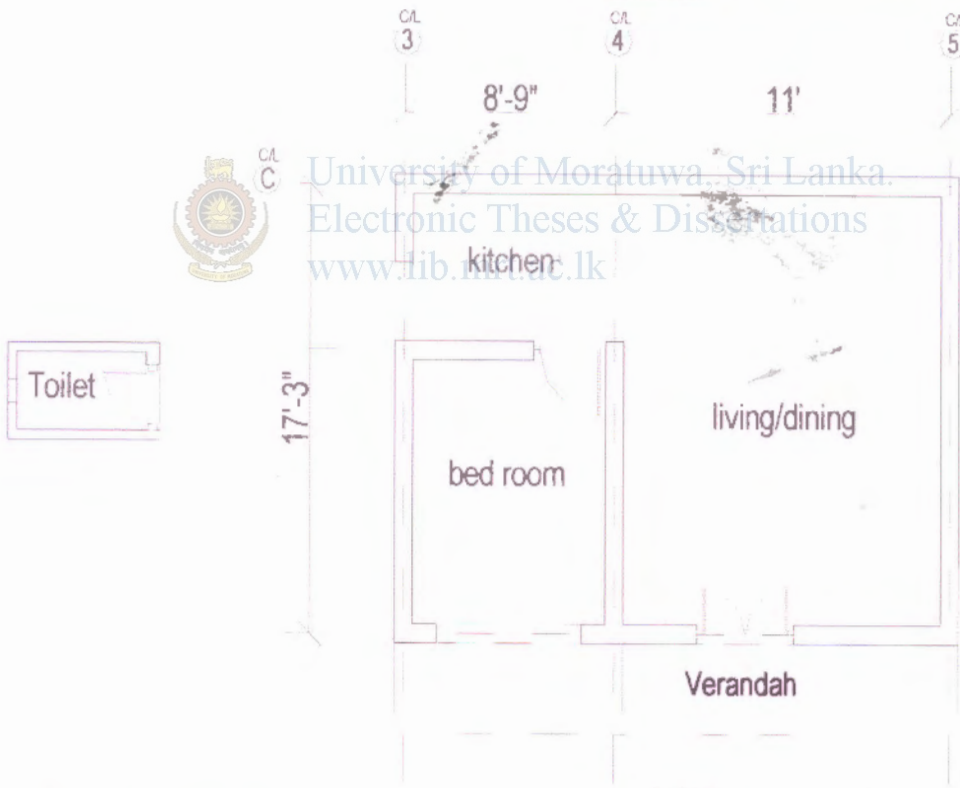


Fig. 89- Individual unit 1

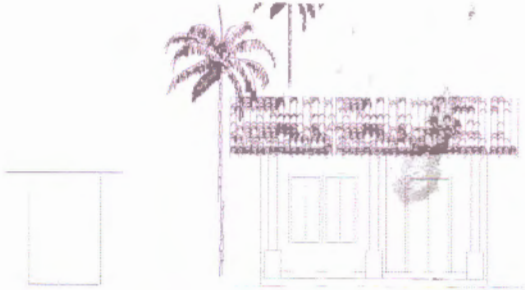


Fig. 90 Front Elevation

The other type is faced to secondary roads, without a verandah. Toilet is attached to the house. Providing facilities for indoor living. There are two bed rooms. One is Open to the Kitchen, and the other one is open to the living room.



Fig. 91- House without verandah



Fig. 92- Individual Unit 2



Fig. 93- front Elevation

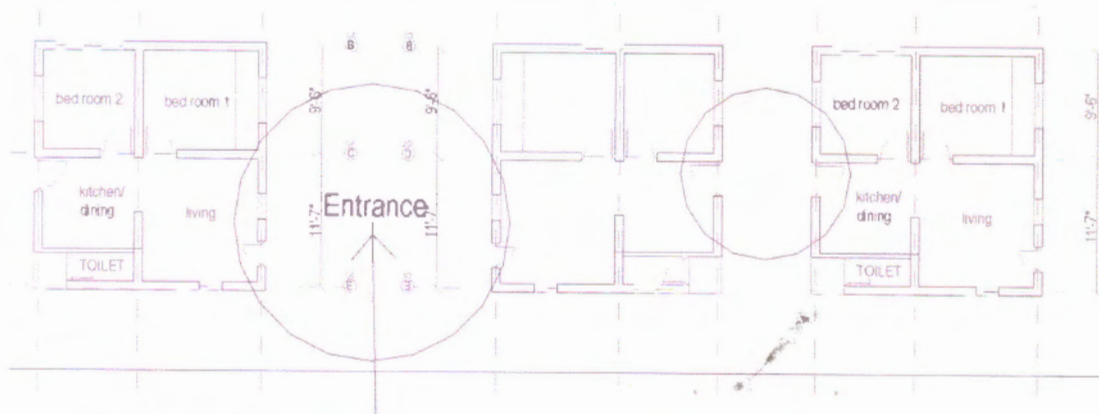


Fig. 94- Layout of Cluster

Kalmunai and the other areas in North east, people prefer to have bed room access from the kitchen. It is called “bed rest room”. The women can keep attention with their children while preparing foods.



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According to the layout of the cluster, side entrance is creating common spaces which facilitate social interaction with the neighborhood.

There is no provision for future expansion.

Construction materials

The houses are consisted of cemented floors. Walls are made out of Cement blocks and plastered and painted. Columns are also constructed with cement blocks.

Roof is consisted of unplane coconut rafters and Calicut tile roof cover without a ceiling. Gaps between the tiles provide ventilation. Wooden doors and windows have been used.

Cement, calicut tiles and coconut timber are the most available materials in this area.



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The houses are in same construction period. Hence get benefit of labour efficiency, cost effectiveness, minimum material wastage and easy supervision.



Fig. 95- construction period

Rubble and clay bricks have been also used as construction materials



Fig. 96- construction materials

Chapter three-

Identification of the Architectural aspects on Resettling Tsunami victims

Most of the housing settlements damaged along the coast were developed over long period of time. They represent distinctive regional characteristics in the built form stemming from the responses to different climatic forces, available construction materials and more importantly to the socio-economic requirements of the occupants.



Fig. 97 Existing fishing community

The form of the settlements and houses has undergone change in the past decades. But they still possessed regional identities.

Man and his environment, specially the built environment, are no two different things, because the built environment of man is subject to wide social, political and cultural influences. It reflects society and communicates the values of society.

Architecture reflects the ideals of the society. It is man's outlook of life. It is the ultimate scope of man's desire, creative talents and achievement of science and technology.

Whenever re settlements are to be undertaken at the end of a disaster, professionals are caught unprepared. Examples around the world show that, had the people been prepared, they would have undertaken these responsibilities more effectively and confidently used them more productively to move in to the future.

Thus it was felt that time is ripe to begin to talk about the Architectural aspects in resettlement. It is with such intentions that have initiated some thoughts and opened up lines of making for others to ponder.

3.1- Kirinda Resettlement

3.1.1- Positive aspects

Layout

Considering the resettlement of Muslim community, although Archt, Shegaruban is a Japanese person, the overall layout functions well, because of the analytical study of the area and the community participation. Critical issues have been solved, because the affected people have been locating in same area.

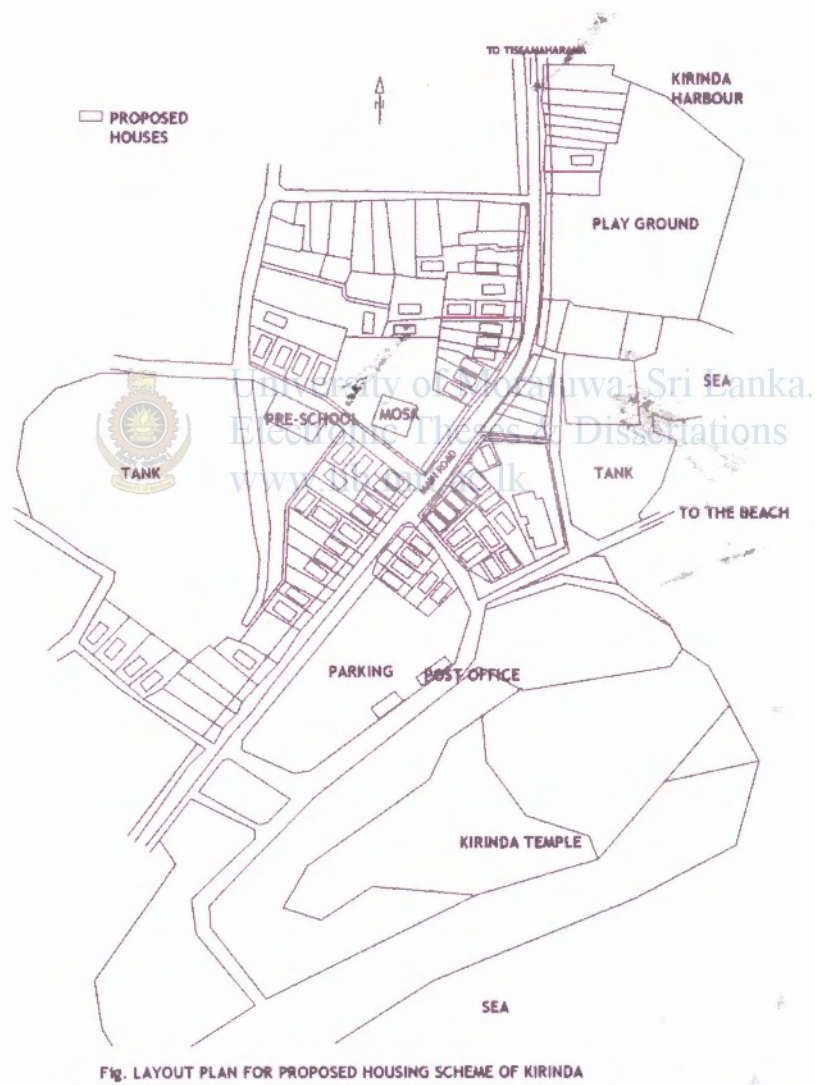


Fig. 98- Layout plan

Considering the layout of the housing scheme, though the Muslim fishing community is located there, the domination of the Sinhalese Buddhist people of the area have been continued further. Muslims are didn't will to move another location, because their life style is hardly bound with the sea and fishing activities.

Archt. Shegaruban has provided large open parking area near the temple for the pilgrims. And there are shop houses in front of it. That has created a transitional space in between the housing scheme and the temple. The activity of the temple premises and the housing scheme is diluted in the transitional spaces. It will be a commercial hub at the future development. Landscaped parking space acts as a buffer zone.

Existing abandoned tank is landscaped and proposed as recreational zone, while providing community gathering space not only for the Muslims, but also for e other communities.

The focus of the design is not only on the individual houses, but also it is about the whole layout of housing scheme.

Proposed Mosque is located center of the housing scheme. Community participation has been taken in to consideration at the design process of the Mosque, because it is a religious building.

Architect has designed it perfectly, to harmonize with the Temple and its existing situation.

Individual Units

Dwelling unit is facilitate with a open space, which is considered as living area and located in the middle of the house, providing better ventilation.

This space creates link between the adjacent units also. Living space faces to the secondary road with creating a pocket with adjacent unit.

Attached kitchen and the toilet uplift the lifestyle of the inhabitants. Individual housing unit maintain social interaction with the neighborhood.

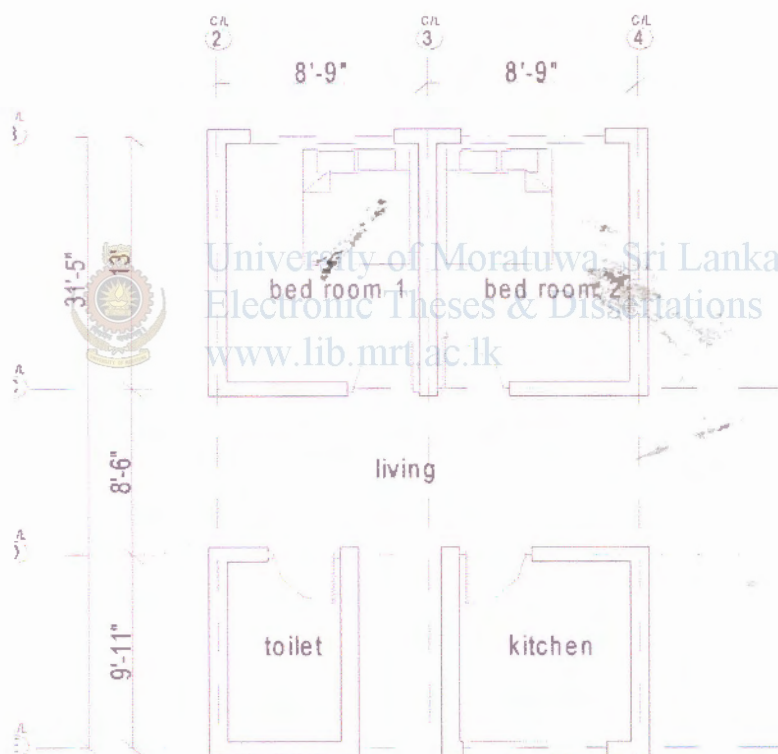


Fig. 99- Individual Unit



Construction period

Cost efficiency, Labour efficiency, minimum material usage and easy supervision can be identified because all housing units were done in same period of construction.



Fig. 100- houses are in same under construction stage

Introduced new clay and cement mixed blocks, reduce the heat gain and provide comfortable living inside. As a construction material, clay which is available in village premises has been used to produce the introduced clay and cement mixed blocks.



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Fig. 101- Clay & cement blocks

The gap between wall and the roof, creates stack effect.



Fig. 102- Individual house

3.1.2- Negative aspects

Bed rooms of the housing units are faced to main road. So inhabitants have lost the quality of privacy at the only private space of the unit. Also the used of imported timber for the roof structure is not cost effective.



Fig, 103- Front Elevation

Open living space doesn't function well as it is meant to. The space hasn't a quality of living space.

It is disturbed, because of that people have used to block the openness of living space with the aid of temporary structures.

The lack of future expansion is evident in an individual housing unit.

Because of Archt. Shegaruban is a Japanese person he is not much familiar with the existing locations, culture and attitudes of Muslim fishing community.

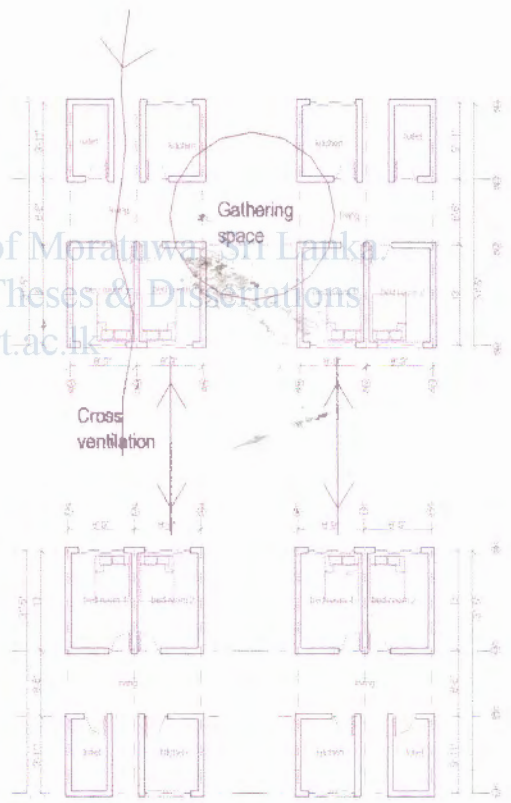


Fig. 104- Cluster

Although the housing layout function well individual unit make some negative issues on the living pattern of inhabitants.

He has used some of the first class imported materials, it is not cost effective.

3.2- Peraliya Resettlement

3.2.1- Positive aspects

Peraliya is developing as a multi cultural village, because different sub societies have clustered together.

Movement from the camp to the transitional houses makes a major change of a living environment for the affected people.

Wooden raw houses have been raised from the ground, to avoid the flooding effect. People feel sense of community in raw houses.



Fig. 105- Individual transitional house

Spaces can be converted to different functions by subdividing the common space.

So in the individual houses, the family can make decisions regarding the interior arrangement as they prefer. In the transitional phase, an attempt has been made to physically demarcate the territory of a family by means of fence in front and the rear.

Government decision is to keep a 100m no built zone along the coast to conserve the coastal belt.

The identified lands for the new settlements are located at a considerable distance away from the original plan where they were.

In Peraliya, most of the assistance teams are erecting permanent settlements far away from the beach, behind the railway line.

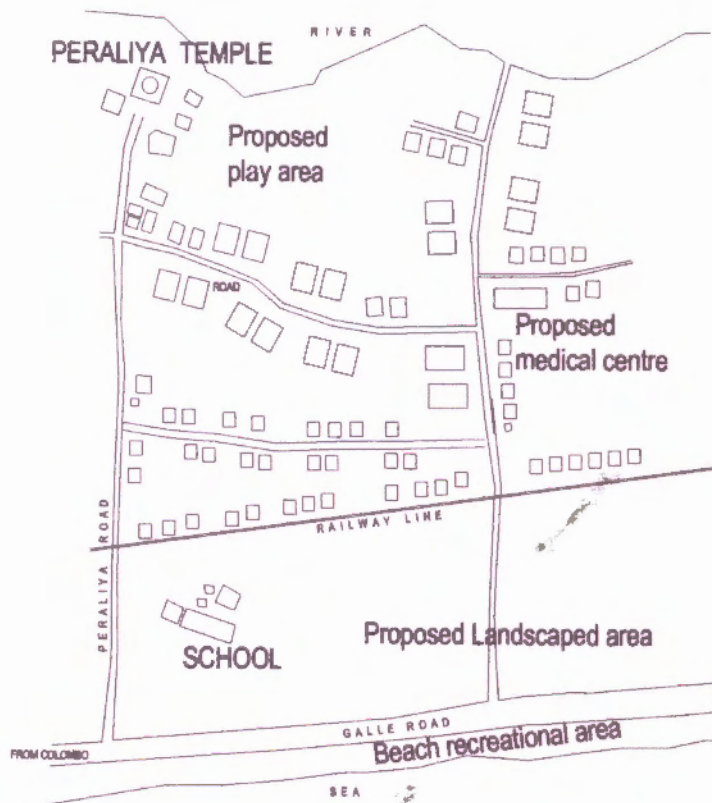


Fig. 106-Proposed lay out

The layout of the housing schemes is geometrical, Pre School, community centers play ground have provided for common activities. The houses are arranged while creating narrow path ways.

Considering the individual unit, Front verandah facing narrow roads, function as a multi functional space for the inhabitants. Create informal gathering space.

Attached kitchen and the toilet uplift the living slandered of them. Cluster houses are create common spaces for public participation.

3.2.2- Negative aspects

In the emergency stage, foreign involvement is highlighted. Provided tent structures are not suit to the tropical climate condition. Inhabitants felt uncomfortable and move to another option or made changes of tents.



Fig. 107-Tent school

Fig shows a congested School under a tent. They have raised the tent to get ventilation.

The expensive tents sent from the western countries did not suit the tropical climatic conditions. In the case of Peraliya, they had to move tents to higher ground to escape save from the flooding.



Fig.108- Raised tents

The situation is same in the wooden transitional houses. They have faced several issues because of the climatic conditions.

They are totally covered and no proper windows. It makes uncomfortable living without adequate ventilation. Some of the individual houses have been constructed in the beach and still they remain. Again it will create haphazard development in the future.



Fig. 109-Flooded wooden house

Professional team who has designed the housing scheme proposed to move the new settlement in considerable distance from their original places.

Then the fishing communities have faced issues on their life style. There is no room for the community to take part in the design stage, because they need quick solutions.

Considering the housing unit, Attached toilet and bath room is not function, because the inhabitants are prefer out door living, Because the professional team has not identified their responsibility in considering the sense of resettlement.

Most of the identified places in peraliya, communities do not will to adopt to new environments, where in the new settlements. They have moved to their beach life back.

There is no provision for future extensions.



Fig. 110-Permanent house

Because of the foreign Architectural involvement, they have not responded to the social cultural back ground of the fishing community as well as the climatic condition of the area. It creates issues on their life style, because individual units not suit for fishermen.

So it is despicability of professional team to understand the real sense of climatic conditions also effect them, because some of the housing units are oriented through the east west axis. Houses are exposed to the direct wind and rain.

3.3- Kalmunai Re- settlement

3.3.1- Positive aspects

As immediate resettlement, the long tent structure, facilitated for several Muslim families, because in Muslim communities, several families used to live together. Though it is an immediate settlement, quality of their lifestyle has been considered.



Fig.111-Long temporary structure

When it is concerned on transitional houses, inhabitation has the certain degree of authority to modify it.

The life style of the people in the North east is so simple and restricted. Tsunami provides great opportunity to re built their nation again. In long term response, professionals are identified suitable land, where is located in considerable distance from the original lands.

Each family got 500 sqft permanent houses, giving same facilities to the every affected community. According to the typical layout they have promote indoor living.

Considering the single unit, there are two bed rooms, living, kitchen and toilet. Toilet is attached to the house. In the existing situation most of the fishing families haven't toilets. Kitchen was in the out side of the house.

It is an attempt to uplift their life style and it will be the first step to the future development.

Also, victims have been introduced with two type plans. So it is littlewise opportunity of selecting what is suitable for them.

Considering the construction materials cement blocks and calicut tiles which are available in the area have been used. like permanent materials. These protect the inhabitation by the climatic conditions like high wind and monsoon rain and heavy sun light.

3.3.2- Negative aspects

Considering the covered temporary tent structures, they do not match with the living pattern of the some of the communities like fishing, because their lifestyle is bound with the out door living.

North east is a windy hot climatic zone. There fore Some of the tents structures can't withstand in high wind. In door living is uncomfortable because of the heat gain.

Although the affected people got permanent houses, some of them have moved to the beach again, and settled down in temporary structures which made out of available materials.

Because of resettling they have been a parted from the see where they have close relationship earlier.



Fig.112- Temporary shelter



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According to the government decision, every family got 500sq ft unit. But some of the law income people can't change their lifestyle with the new facilities, and no ability to maintain.

They have built temporary shelter near the permanent house and it is used while the permanent house is remained. In other hand middle income people are not satisfied available facilities.



Fig. 113-Existing palm leave structure

Already they have attached kitchen with the permanent house, in some places they have built outside kitchen, because they prefer out door cooking and preparing , while communicating with neighbours.



Fig.114 - Addition of outside kitchen

Although the toilets are detached in the house, people do not like to use it. They have move to the beach.

Proposed housing development not suits with the lifestyle of the inhabitants, because of the lack of community participation and not analyzing their background before starting to design permanent settlements.

As it is lack of identifying victims life style which has to be consider in design stage, uplifting victims life style is not by introducing new, but changing existing in a proper way, that can be accepted by the people.

Conclusion

Natural Disaster could create an impact on the built environment basically in two ways; one could be the direct impact, the destruction of the buildings and the components of the fabric of the built environment of man.

On the other hand, it could be due to a disaster that had occurred in a certain place, the temporary and permanent migration of people, from their homes, neighborhoods and from places, to which they belong, to other places too, create an impact on the built environment.

Resettlement after disaster is done with the contribution and input of many professionals of many fields. But it is important to identify the role of architect in the process of resettlement, because the built environment is the main component which has a long chain of interactions, such as socio cultural economical technological and environmental aspects.

Community's identity depends on its belongingness to the location, where they settle. Hence, the destruction of the built environment creates an impact on community and its identity.

Therefore it is important to understand, Resettlement is a sensitive issue as far as the community affected concerned. Hence it was made clear in this study, that though the loss of the built environment and its fabric, man loses the spirit, individual identity and the identity of the community.

The three case studies are discussed about the professional and non professional involvement in resettlement of affected communities with various social cultural and economic backgrounds. It can be identified that most solutions in resettlement have not always been successfully accepted by people.



The Architectural involvement recreates the qualitative physical environment, which would reflect society and communicate the values of the society which was lost.

Considering the Kirinda resettlement, though it is design^{ed} by a foreign architect, The Layout is functioning well, because the community would have blend^{ed} with their social, cultural, and economical environment in successful manner. It reflects importance of user surveys is also important, because community participation is a vital issue in re settlements.

It is concluded; that the Architectural involvement in resettlement is not only for the community satisfaction, but also^{for} provision for the successful future development.

Considering non professional involvement in Kalmunai, it is not practical by the larger scale. The reasons of failure in re settlement don^e by the non architects, because of the quick solutions for the available cost and materials, which is not considered the affected community and their background for the long term planning.

Disaster is a tragedy in to an opportunity for development, because when the architects are involved, they can create same special qualities of the places used and enjoyed by the people, before the destruction, re creating them using modern methods and techniques and making opportunity to future developments.

It is able to come to summaries that, since the rejection or failure are concerned with the end product of architecture, the actual problem could be found in the design process. If the identity and cultural importance of the community could be taken in to consideration, and fitted in to the design process, the product of re settlement would be successful.

It is concluded that the re settlement is a development process, which gives input in to the built environment, while providing the link between the past, present and the future, for establishing man's sense of belonging to the built environment.

Architecture is articulation of built environment meaningfully. There fore Architectural involvement is essential in re settlements.

Bibliography

Books

1. Allsopp, B.(1974), *Towards a human architecture*, London: Frederick Muller Limited
2. Aysan, Y, Oliver,P.(1987), *Housing and culture after earthquakes*, Oxford Polytechnic, Oxford:
3. Canter, D.V, (1997), *Psychology of Space*, Architectural Press: London
4. Day, C. (1990), *Peaces of the soul*, London: Aquarin press
5. Frederic, C.C (1983), *Disaster and Development*, New York: Oxford University Press, New York.
6. Oliver, P. (1981), *disasters and small dwellings*, Hiroshima: Gimmick Ltd.
7. Ravertz, A. (1980), *Remaking cities*, Oxford: Pergomon Press
8. Schults, N. (1969), *Existence space and Architecture*, Studio Vista: London
9. Smith, K. (1991), *Environmental Hazards*, London: Routledge, New fetter lane, London
10. Ward, C. (1985), *when we build again*, London: Pluto Press Ltd.

Journal, Articles

11. De Silva, L.(2005), “ Re housing Tsunami Victims”, *The Sri Lanka Architect*, Vol.106-No.01, pp. 32-35
12. Kulatilaka, P. (2004), “ Disaster as an opportunity”, *Vastu*, Vol.21- No. 01, pp. 8-12
13. Kodikara, P. (2005), “Rebuilding after Tsunami”, *The Sri Lanka Architect*, vol. 106- no.02, pp 10-11

